PUBLISHED EVERY SATURDAY BY

THE W. J. JOHNSTON COMPANY, Limited,

167-177 TIMES BUILDING, NEW YORK.

Established 1874. Incorporated 1889.

Telephone Call: Cortlandt 924. Cable Address: "Electrical," New York.

New England Office, 28 Hathaway Building, Boston.

Western Office, 465 The Rookery, Chicago.

Philadelphia Office, 927 Chestnut Street.

SUBSCRIPTION, IN ADVANCE, ONE YEAR $3.

(Including Postage in the U. S., Canada or Mexico.)

In requesting your address changed, give **old** *as well as new address.*

ESTABLISHED 17 YEARS AGO, THE ELECTRICAL WORLD is the Pioneer Electrical Journal of America, and has well maintained its lead. It has the LARGEST CIRCULATION of any electrical periodical in the world, and is the BEST ADVERTISING MEDIUM.

Advertising Rates are much lower than those of any other similar publication, circulation and standing considered, and vary according to space, position and number of insertions. Quotations promptly furnished.

Correspondence, views and opinions on all topics within the province of this journal are cordially invited from any part of the world. We will thank readers to forward to us—**promptly** as they occur—**Items of News,** or information relating to any application of Electricity, also marked copies of their local papers containing anything likely to interest electricians. Anonymous communications cannot be noticed, nor can rejected manuscript be returned unless accompanied by the necessary postage when received.

Situation or Help Wanted advertisements $1 to $2 an insertion, according to length.

Address all communications to

THE W. J. JOHNSTON COMPANY, Ltd.,

Times Building, New York,

OR ANY OF THE BRANCH OFFICES.

VOL. XVIII. NEW YORK, DEC. 12, 1891. NO. 24.

CONTENTS.

EDITORIAL: PAGE
Paragraphs ... 427

ILLUSTRATED ARTICLES:
Some New Forms of Illumination ... 429
Electric Fixtures for Exterior Illumination.—II ... 430
Electricity in Mining.—III ... 433
New Form of Insulator ... 438
The Q. & S. Cord Adjuster ... 438
The Rushmore Multiple-Series Lamp ... 438
Loose Wheel Electric Truck ... 438
The "New Era" Gas Lighter ... 438

MISCELLANEOUS:
Latest Foreign Electrical News ... 428
A New Engineering Firm ... 428
Safety Devices, by C. C. Haskins ... 428
Rules of The World's Fair Department of Electricity ... 429
Electric Railway Lines in Galveston ... 431
History of Electricity, by P. F Mottelay ... 432
Elements of Practical Electricity, by Dr. Louis Bell ... 434
Some Remarks on Safety Devices, by Forest Bain ... 435
A New Method of Electroplating with Aluminium ... 435
Government Telegraphs, by E. Rosewater ... 436

FINANCIAL INTELLIGENCE: The Electrical Stock Market, 439; New Incorporations, 439; Affairs of the Companies, 439.

SPECIAL CORRESPONDENCE: New York Notes, 439; New England Notes, 439; Western Notes, 440; Southern Notes, 440; Canadian Notes, 440; English Notes, 440.

NEWS OF THE WEEK: The Telephone, 440; The Electric Light, 441; The Electric Railway, 441; Legal Notes, 441; Personals, 441; Miscellaneous Notes, 441.

INDUSTRIAL AND TRADE NOTES ... 44
BUSINESS NOTICES ... 442
OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS ... 442

Another Electrical Execution. ANOTHER murderer has suffered the just penalty of the law, and was executed on Monday of this week in the way prescribed by statute. The manner of his end differed in no essential particular from the experience with four other brutes last summer. We mention the execution here only for the purpose of noting that the hysterical excitement over electrical execution has died away and it has sunk in the estimation of the press and public from a legalized martyrdom by the "deadly current" to the common place level of an old fashioned hanging, where it belongs. Now that the ubiquitous reporter has partially restrained his imagination and his blood-and-thunder head lines, we hope the whole matter will drop out of public interest. It is a pity that the law was ever passed, but since it exists, the less said the better for all parties concerned.

Manufacture of Storage Batteries. AN interesting hint on secondary batteries may be found in our cable dispatch this week. It discloses nothing less than a strong tendency on the part of English makers to abandon the pasted plate in favor of modifications of the old Planté cell. There is hardly any department of electricity in which more ingenuity has been spent than in the improvement of the accumulator, and mostly without commensurate results. The pasted cell was the result of an attempt, first to procure active material cheaply, and second to increase the proportion of active material to supporting plate. These points were gained but some others were undoubtedly lost, for the very thin layers of lead oxide and reduced lead on the Planté plate are certainly less subject to local action and some other inherent disadvantages than the solid plugs of the grids. Perhaps a happy medium be tween the two may be devised, as has been attempted in the case of the well known Tudor cell abroad, and meanwhile the alkaline accumulator begins to come to the front. There are plenty of workers in the field, and if there is any chance of perfecting the storage battery, the amount of investigation it has received ought to lead to something. The present tendency toward trying something beyond infinite variations in the mechanical form of grids is rather hopeful and may lead to important results.

Cheap Aluminium. ALUMINIUM may fairly be called the foster child of electricity, for up to the time when the Heroult process and its various modifications came to the front the lightest of the important metals was only a chemical curiosity. As the electric processes have been more and more perfected it has come to be a commercial product, and, although not yet used for very many purposes for which it is immediately available, it is likely to assume more and more prominence. An interesting scrap of news comes just at this time from the other side of the water; this is a reduction in price of aluminium of ordinary grade to so low a figure as 57 cents per pound. This reduction, made by the company at Neuhausen, the largest manufacturers on the continent, is stated to have resulted in an immense increase in the demand, and presumably, therefore, in the profits of the manufacturers. It is quite possible that the commercial conditions existing here may for the present forbid American manufacturers meeting the current German rate, for to our country's credit be it said that labor is much better paid here than there, but it is nevertheless quite clear that it will not be long before the price of aluminium—thanks to the resources of the electrician—is reduced to a point where the metal can be employed for a wide range of uses not now practicable. A fall in price from $2 to $1 per pound still leaves the cost so great as to very seriously limit the demand; at 50 or 60 cents a pound, however, aluminium is within reach of effective competition with other materials for a very large variety of work.

The Province of the Consulting Engineer. A QUESTION has been frequently asked us which has become of late more and more pertinent—what is the present and future of the electrical engineer pure and simple, the consulting engineer as distinguished from the contractor and the manufacturer? In other words, has the time come when the public realizes that an electrical architect should be engaged for putting up an important plant on just the same principle that an architect would be consulted if one were erecting a great building. It is an easy question to ask but a hard one to answer, for the electrical business is still in a somewhat chaotic state. There ought to be a good field for the consulting and supervising engineer; there will be unquestionably at some future time, but whether there is one now, is anything but easy to determine, except by the heroic method of trying it. Supposing a capitalist intends the erection of a great office building, what would be thought of him were he to go to a number of contractors and say, "I want to put up a 13-story brick office building on a ground space 80 × 100 feet, the whole to contain 455 rooms; what is the lowest price you can put it up for and guarantee it to stand?" And yet the same man, becoming interested in electric lighting, will dicker with half a dozen manufacturers' agents for the installation of a central station of 5,000-lights capacity, having himself only the vaguest ideas of what would be required, and finally buying his machinery of the fellow who will make the biggest promises and take the largest percentage of his payment in bonds. The work may or may not be well carried out. It is, of course, for the interest of the manufacturing companies to sell as much apparatus as they can, and for the sake of their reputations to sell good apparatus, but if there is an opportunity of working off discarded patterns which will give fair service under the circumstances, the contractor is more than human if he does not take advantage of it to a greater or less extent, just as the contracting builder would skimp whenever he saw a good chance in order to increase his profits. It is evident enough that the more reasonable course would be in the one case to engage an architect to make proper plans and see that they are carried out, and in the other to seek the advice of a competent electrical engineer to arrange for the installation and superintend the execution of the details. The public is gradually beginning to see all this and the larger enterprises are not infrequently conducted on such a rational basis; but up to the present the handling of such matters has depended more on that indefinable but potent something known among politicians as "pull," rather than any clear recognition of the necessities of the case. The past few years have seen great changes in methods of doing electrical work and in the quality of the manufactured products. While such changes continue it is advisable for the buyer to keep his eyes wide open and to employ another pair of eyes to watch while he sleeps. What form the business will take eventually it is not for us to predict; for the present, however, the consulting engineer ought to have a wider province than has as yet been accorded him.

The Government Control of Telegraphs. ELSEWHERE in our columns will be found the somewhat lively presentation of this much vexed topic that took place at the New York Electric Club on Dec. 3. It has been of late rather a favorite theme with political economists and would-be reformers to point out the alleged advantages of transferring the great monopoly of telegraph business from the hands of its present private owners into those of the government. There is very much to be said on both sides of the question, so much in fact as to leave the mind confused after a discussion rather than the clearer by the information that has been secured. Much of the argument has usually been based on the experience of foreign governments in the administration of telegraph monopoly. It is scarcely necessary to point out, however, to one who is thoughtfully considering the question, that conclusions drawn, for example, from England's experience are nearly worthless as applied to American conditions. On the one hand we have a country of enormous extent with a population comparatively scattered, distances far too great to permit of putting the wires under ground and a winter climate so severe as to imperil their safety when placed over head; on the other hand we have a small, densely populated island, compassing in an area scarcely larger than many of our single States a population one-half as great as that of our entire country; the longest distances to be spanned appear almost ridicuously small to us; great cities are so near together that it is exceedingly easy to care for the telegraph mains connecting them, and in addition the climate in itself not especially favorable to the daily operation of telegraph lines is yet equable enough largely to avoid the danger of the almost complete paralysis of the telegraph system which has happened more than once within the past few years in the United States. Beside this there is in England a civil service system, imperfect it may be, but yet of such a character as to insure the permanence of the working force of the telegraph system, while here the use of our only government monopoly—the mail service—as a political engine is only too familiar. Comparisons drawn from such divergent data can have but little value. Taking all this into account it is no easy matter to establish even the strong probability that governmental control of the telegraph would insure to the public a service better or cheaper than that which it at present has, and even were it certain that the government could administer such a department of its business more economically than is now done, it still remains very doubtful whether the service would not suffer every four years from an upheaval so complete as to paralyze its functions during a long period of reorganization. Government monopoly is likely to produce very different net results under a republican and a monarchical form of government, owing to the very disturbing facts of political changes, and even the same government which operates one monopoly most successfully may fail in administering another and a different one. For a very crude example, the German telegraph system has been much lauded; the German government railway system, however, is such as would make one of our great railroad magnates hang his head for shame, and who can have the hardihood to assert that the German government monopoly of tobacco has improved the quality of the cigars! The telegraph system has been extended and brought to a high state of efficiency as a military necessity, and the lines and force existing, therefore, are available for the public. The railroads which in time of war would have to be turned over to special service for the government are plentiful in number and resources, but on a peace footing are anything but satisfactory to the public. So here in America the government out of the commercial necessities forced upon it by its citizens has established a splendidly successful mail service; it might make a success of the telegraph, and it might make a failure. Indeed, it has not made a shining success of the special delivery system which was so loudly heralded, and which might form a very useful adjunct to the mail service. And is it not along this line that the Post Office Department might be well improved without at once stretching out its hands and seizing upon the telegraph lines? For example, as an initiative in a new sort of mail service, why could not all the post office stations in New York be connected, not by pneumatic tubes as is done in London, but by telephone lines, so that a message from any one station could be dictated to any other station and sent out as a special delivery letter? Such a system could be established at a comparatively low cost, would be for certain purposes much more effective than a telegraph service, and might be the starting point for a special delivery service of real use and efficiency to the public. Eventually it might be extended from centre to centre of population, and would always prove a most valuable adjunct to our present mai system. It might be objected that this would be practically like government control of telegraphs, but to this it may be answered that a telegraph system in the hands of the government cannot be advantageously much less extensive than that now existing, while a special delivery of the sort described could be used merely as an adjunct to the rapid transaction of business in large cities and extended only so far as the immediate necessity for it might dictate. It would be only an improvement and amplification of the pneumatic tube system used in England to-day.

Latest Foreign Electrical News.

(By Cable from Our Own Correspondent.)

LONDON, Dec. 7, 1891.—The authorities of the London municipality have refused to grant an extension of the time for the fulfillment of the contract for street lighting entered into long since. There has been much indignation expressed at the seemingly unnecessary delay, and it has taken tangible form in this peremptory refusal to permit further procrastination.

The Glasgow municipality has at last purchased a site for its central station, although the details of the installation are still undergoing lengthy consideration by Prof. Kennedy. The purchase of the site, however, at least gives promise of something being done.

On Tuesday last Prof. Ewing communicated an important contribution to the Cambridge Physical Society which contained the result of careful experiments on the hysteresis losses of transformers, a question that has been already often debated. Prof. Ewing, however, after instituting a careful search found absolutely no indication of decreased losses on heavy loads.

On Wednesday there was an interesting discussion before the Society of Arts on the subject of secondary batteries. Mr. G. H. Robertson, F. C. S., in the course of this discussion mentioned the very significant fact that English makers are now mostly reverting toward the old Planté cell instead of the pasted accumulator, although they are also casting a friendly eye on the alkaline accumulator, forms of which have been before the public for several years.

A New Engineering Firm.

It has just been announced that Frank J. Sprague, Dr. Louis Duncan and Dr. Cary T. Hutchinson have combined their energies and will enter the field of general electrical engineering under the firm name of Sprague, Duncan & Hutchinson, with offices at 15 Wall street. The new firm propose to do a consulting and supervising business without personally undertaking contracts. It will be hard to find gentlemen better fitted by education and training to undertake work as electrical experts and engineers. Both Mr. Sprague and Dr. Duncan have become widely known during the past few years and have more than national reputations.

Dr. Hutchinson was introduced to the scientific world through important work done in determining the true value of the ohm, and since entering practical life with the Edison company, and later as Mr. Sprague's assistant, has become well known as an able electrician. The trio has the earnest wishes of many warm friends for its immediate and continued success, and as the field is a wide one there is little doubt that it will find its activities fully occupied.

Safety Devices.*

BY C. C. HASKINS.

The law of Ohm, that multiplication table of practical as well as theoretical electricity, tells us, as you all know, that with a given source of electricity the current that will traverse any conductor is regulated by the resistance of that conductor, and it is also well known to you that resistance or opposition to the flow of current results in the development of heat.

These two factors are made available to furnish the equivalent of the safety valve for a steam engine, or better, perhaps, the soft plug in a boiler, to stop the strain; in the one case to prevent an explosion, and in the other to forestall a conflagration.

Various metals having different electrical carrying capacity must necessarily be variously affected thermally, and as some of these fuse at a much lower temperature than others it is readily seen that protection from abnormal heat in an electrical conductor is readily arrived at by the use of the fusible strip which, placed in direct line with the passing current, will, before undue heating of the conductor proper takes place, melt and thus break the continuity of the conductor.

Such, briefly stated, is the usual method of protection from abnormal currents. Let us look at this subject for a brief time, and see if in practice this is as reliable as theory would indicate.

The material from which these devices are constructed may be either a simple metal or an alloy of two or more metals in combination. A curious fact in this connection is that an alloy may be made of two metals which has a lower melting point than either of the metals of which it is made.

Those metals which are more commonly used are: Tin, bismuth and lead.

The melting point of tin is 451 degrees F.

The melting point of bismuth is 512 degrees F.

The melting point of lead is 620 degrees F.

* A paper read before the Chicago Electric Club, Dec. 7, 1891.

Authorities differ two or three degrees on these melting points, but that is a matter of small consequence for the purpose of this paper. Now different combinations of these metals will give us widely different results. Equal parts of tin, which fuses at 451 degrees, and lead, which fuses at 620 degrees, will give us an alloy which will fuse at 385 degrees. Tin and bismuth in similar portions will fuse at 250 degrees. One of tin, one of lead and four of bismuth will melt at 200 degrees. Lead 5, tin 3 and bismuth 8 form a combination which melts at 212 degrees. Other combinations will give us an upward range far above the necessities of the case, and the admixture of other metals will give any desired melting point.

Mr. W. H. Preece has furnished us with the results of a long list of experiments in his fuse table. This table gives the sizes of pure wire which will fuse by a current of from one to five ampères, and for each additional five ampères up to 50 by steps of 10 ampères to 100, and by steps of 20 ampères to 200 ampères. These figures are given for tin, lead, copper and iron.

In the matter of safe carrying capacity of copper wire there seems to be considerable diversity of opinion. This appear to be one of the rough spots in the highway to success. There are several tables purporting each to be the best, so that it is rather difficult to decide between them, and as the safe carrying capacity of the copper has something to say as to the capacity of the fuse, the doctors are not all in perfect harmony over the case.

We are told that a No. 0000 wire B. & S. gauge is good for 312 ampères by one authority, a second says 229 ampères, while a third says 300 ampères, and the last speaker says 175 ampères. No. 6 is given at 65.2, 43, 80 and 35 ampères. No. 14 is given at 16.2, 11, 22 and 10 ampères. These various figures come from the Board of Trade of Great Britain, from Boston, from New York and from Montreal. How nearly great minds arrive at solid conclusions!

With such a broad field for selection it would certainly seem possible that a perfectly reliable fuse should be readily accomplished for any known requirements, and yet with such a disagreement of authorities as are above given it is not very strange if the fuse manufacturer should occasionally err in the capacity of the wares he offers.

Mr. Lee L. Summers, assistant electrician of the Western Union Telegraph Company at Chicago, has very kindly furnished me from his note book some facts which are interesting in this connection. Called to devise some means of protection for conductors carrying small currents, such as are used for telegraphy, his experiments with alloys of tin and lead were mostly confined to those of quite small capacity. He says in substance: The smallest fuse placed upon the market was variously stated by different makers. One claimed them to be of one-half, others of one, and still others of one and one-half to two ampères capacity.

These fuses were either lead alone or lead and tin. As a rule the lead fused at a lower temperature than the alloy. The exact gauge of these fuses was difficult to ascertain because of their irregular diameter and the softness of the metal. This lot was samples of so-called one-lamp wire. It melted with between 2¼ and 3 ampères.

Attempts were made to reduce the cross section of these samples, but its feeble tensile strength prevented, for the wire became quite brittle when drawn through the die. His experiments led him to believe that the fuse wire known as of one light capacity would require an average of about 2½ ampères to rupture the circuit.

German silver was tried by Mr. Summers, the wire being drawn down to 36 and 38 B. & S. gauge. This wire fused with from ¾ to 1 ampère and proved quite constant. But the fineness and delicacy of wire of that diameter unfitted it for general use.

Other parties besides Mr. Summers have given this matter much thought and time, and some of the results are even more remarkable. Among these are the recorded experiments of one investigator with a lot of fuses marked "15," which stood up nobly until melted by 30 ampères. This mark "15" may have meant 15 lamps, but it is charitable to believe it should read ampères.

There is, perhaps, a grain of consolation in the fact that the professional inventor electrician has his eyes open to the needs of the hour. One of these recently patented an automatic combination by which, if a fuse burned out, a wire of greater capacity would be instantly substituted. It is unfortunate that his idea had not progressed a few steps farther. A series of such substitutions ending with a bus bar would have made the invention complete. An inspector would then be superfluous, and the grounds would take care of the plant.

In close proximity to the safety strip matter is another to which I call your attention because of the possible danger which may at any time be drawn from its lurking place through the ignorance of the general public of electrical laws. The electric motor is marching boldly to the front with a double quick movement—a sort of Yankee Doodle alacrity—and ensconsing itself on the shelf or the counter, under the table, or over the cupboard, never twice consecutively in a similar locality, hardly twice consecutively to labor for the same accomplishment. A mere infant, it turns a mimic windmill over the desk of a bank cashier or railroad official. Grown a trifle larger it takes charge of and moves the foul air of a kitchen or a beer cellar, and arrived at maturity it grapples fearlessly with the passenger or freight elevator, or cheerfully manipulates the printing press, either class of labor being apparently recreation to the little giant, who never turns a hair and seldom dampens its collar by the exertion.

But while all this is accomplished to the perfect satisfaction of those who are using electricity for such and similar purposes, of course there must be somewhere a safety valve, a blow off system or check rein, by which to control the giant when a tug strap breaks or a thill drops down. "Of course," I think I hear some one say, "there is the rheostat and the ampère strip." Yes, but like the strips and wires we have been examining, these are assumed to be constructed of proper alloy made of proper size with no flaw in their attachments, but cases have been known where the ampère strip, probably by accident, or through color blindness, was of 97 per cent. copper.

For the sake of the discussion we will assume that the safety device possesses all the necessary qualifications, and yet under certain circumstances very deplorable results may develop when least anticipated.

The motor switch, as often constructed, has now and then the uncomfortable habit of stopping at an intermediate point between off and on, thus leaving a portion of the resistance in circuit, and of course a part of the current flowing through it. This current may or may not be sufficient to move the machine, and the switch may be left in that position intentionally or accidentally. When the quitting time arrives, there are few employés in any establishment who are not ready to rush for the door. It is very easy to stop a machine by throwing the switch lever part way over in the haste of quitting time, and had we nothing better than theory to base the statement upon, it might be hard to prove that such an act of carelessness was ever committed.

Let me give you two dissimilar cases, which I assure you are authentic. There are more where these come from. A fan in a restaurant was run by a motor, and doing excellent work during extremely hot weather. The weather changed suddenly, and the economical proprietor thought to save some current and run his motor slower by turning in part of the rheostat. He knew just enough of electricity for that, and his little learning proved a dangerous thing. You have anticipated the result: It didn't melt out the safety plug, but it heated the Fire Department and warmed the underwriters.

In another case a small motor was used to run a light piece of experimental machinery in a dark corner of one of Chicago's sky-scraper buildings. It required all the current to run the fake, whatever it was, and when the schemer left the room at night he turned the switch just far enough to stop the motor, locked up and went home. The department extinguished the blaze about two o'clock the next morning, and the fuse was not injured.

Now mark, these two cases show that under some circumstances the best of soft strips may be thoroughly valueless.

I feel that it is in the mouth of every motor man present to remark, "that was not our motor." You are right, gentlemen, as usual. It was the other fellow's motor—provided he is not present—but it did the work just as well as a better one might have done it.

Seriously, this state of things has existed, and does exist to some extent to-day, and yet the remedy for this class of danger seems to me simple and easy of accomplishment. If the stationary motor switch is so made that it can never be left between full on and full off, it can never be so left. That which cannot be never is.

But the soft strip conundrum is not so readily answered. There are several points to be considered.

First. When the ordinary dynamo man requires a wire or strip of a certain capacity, he must perforce take on trust the article that is given him. He has no means of verifying the purchased article, and may or may not get what he requires. And more than that. High authority has advised that all soft strips should be made of sufficient carrying capacity to allow a surplus of 25, 50, or even a larger per cent. excess over the marked capacity. As in many instances there is no mark on the fuse, it is not beyond the range of possibilities that the salesman may err in supplying the purchaser, or that the latter may mistake in replacing a fuse.

Second. The fuse wire may change its carrying capacity by exposure. Oxidation has that effect. If it is firmly fixed when first placed, unless it has a hard metal terminal the constant pressure tends to flatten the contact, and thus loosen the connection, possibly setting up an arc at that point. The constant vibration of a building may be readily shown with a glass of water placed upon a table. This constant agitation tends to loosen any but the most firmly set screw, so that here are two evils to be avoided.

Third. There is no means at hand for effectually preventing the user from endangering not only his own but his neighbor's property, by substituting other than fusible metal in the cut-outs. Some of these substitutes are truly wonderful, not to describe them by any more expressive epithet. I have seen an Edison plug, the melted fuse of which had been replaced by casting the space solid full of lead, and some type metal slugs which I once found in a plant would certainly have frightened a conscientious or timid dynamo man. I once found the largest fuses—those at the dynamo—had been removed, and half a dozen strips of brush copper (more than the equivalent of the wire) substituted.

For these several difficulties there should, it seems to me,

be found reasonable and simple remedies. It was once customary to designate the limit permitted upon a wire by the number of lamps. This is no longer practical. There is such a variety of lamps, so many different voltages, and hence so many differing rates of current absorption, that our only standard of allowance is the ampère. It seem to me that the device, whatever shape it may assume, should be so arranged that its actual capacity at a certain temperature can be known at a glance. The cut-out block should be so constructed that only the strip for which it is marked can be used with it. A 10-ampère block should not be made capable of holding a 20 or 40 ampère strip.

With a given alloy the manufacturer would be able to make his strips uniform, so that the carrying capacity would be easily verified by a wire gauge or micrometer. So many millimetres wide, and so many thick—so many ampères capacity, and no more.

I make these suggestions as a possible solution of a difficulty which is growing formidable, and in the hope that by drawing attention to the existing necessity the matter may be thoroughly sifted and proper remedies applied. It is so easy to go wrong in such matters, and so difficult at times to go right, I sometimes almost feel inclined to think good, pious, Dr. Watts' lines a proper comment on the how-not-to-do-it class of electrical users:

"Broad is the road that leads to death,
And thousands walk together there,
But wisdom shows a narrow path
With here and there a traveler."

Some New Forms of Illumination.

The underlying principle of all artificial illumination, from the earliest times, has been as much ornamental as useful. In the crude oil lamps of ancient civilization we find excellent specimens of the metal worker's art. In the suspended fixtures, such as sanctuary lamps of later days, we see evidences of an effort to harmonize the artistic and the useful.

With oil and candles no great variety of fixture work could be obtained owing to the rigid character of the light, and even with gas the limitation to ornamental work was early established. Whatever the form of fixture adopted, the light had to be burned upward, and this, of course, confined the light to centre clusters or wall brackets.

With the advent of the incandescent lamp, an entirely new art was developed. The lamp being adapted to all conditions and positions, architects were not slow to realize that a new factor had come into existence for beautifying interiors, and greatly assisting architectural designs. The numerous styles of lighting which have resulted are as interesting as they are varied; but we will consider only a few at this time.

Reference was had in a recent issue of THE ELECTRICAL WORLD to the novel lighting effect obtained in the concert hall of the New Madison Square Garden. This single instance is no doubt the most striking illustration of the peculiar value of incandescent lamps for artistic lighting. In Fig. 1 the artist has given us a rough idea of the arrangement of the lights, somewhat briefly described in the article referred to. Although hundreds of lamps are used, there is not an inch of fixture metal to be seen.

In the Columbia restaurant on Union Square we find the same idea of divided light in a somewhat different form from that of the concert hall. Suspended from the ceiling a distance of 40 inches, and arranged in parallel lines, are 50 c. p. incandescent lamps incased in cut glass globes. These globes eliminate the bright lines of the filament seen in the naked lamp, and gives a more pleasing result. As in the first case we have mentioned, a perfect canopy of the most cheerful light is realized. The wires are concealed in conduits, and are controlled from a switch in the rear of the building.

A person cannot help noticing that the architecture of the ceiling is different in the two cases. The advantage would be in favor of the concert hall, did not the glass

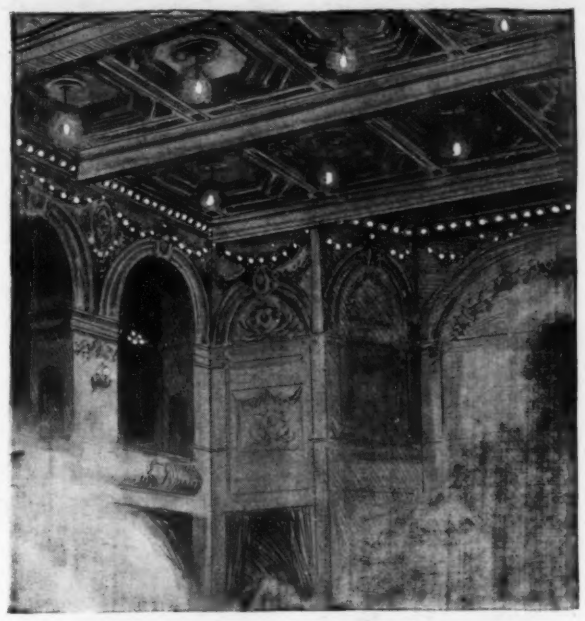


FIG. 1.—CEILING OF THE MADISON SQUARE GARDEN CONCERT HALL.

globes in the Columbia increase the lighting surface, and thus make the plain ceiling an advantage.

Many other instances of this new distribution of light are found in other parts of the city. The Imperial Hotel, on Broadway, was one of the first to adopt it. Here the ceiling is used as a fixture, the lamps being arranged in straight lines around the border as shown in Fig. 2. In the lobby, café, dining saloon and other places 16-c. p. lamps are used to admirable advantage by being attached to the ceiling direct without any fixture whatever.

In the Marlborough Hotel, on Broadway (Fig. 3), we find still another type of decided novelty. The great ceiling of the café is divided into squares, in the centre of which, incased in an opalescent globe, burns a 16-c. p. lamp. The decoration of the room is old gold, and the lamps are set in rosettes of the same shade, securing a sheet of light of the most delicate tint.

It should be noticed that while the idea of a canopy of light is here carried out, the lamps are attached directly to the ceiling instead of being suspended a distance from it. Clusters of three lamps each are arranged on the side walls and on the pillars, neutralizing the light, so that every corner of the room is supplied with an equal amount.

Considering that the units of light used in the cases we have mentioned are necessary, it would be impossible, with any kind of fixture yet devised, to obtain a total illuminating effect equal to that now realized. Instead of being arranged in one solid mass or at several points from which a great amount of light would have to be radiated at one time, the lamps are scattered, so that while the same amount of current is used in either case, a greatly increased percentage is naturally secured by the plan which gives the greatest distribution.

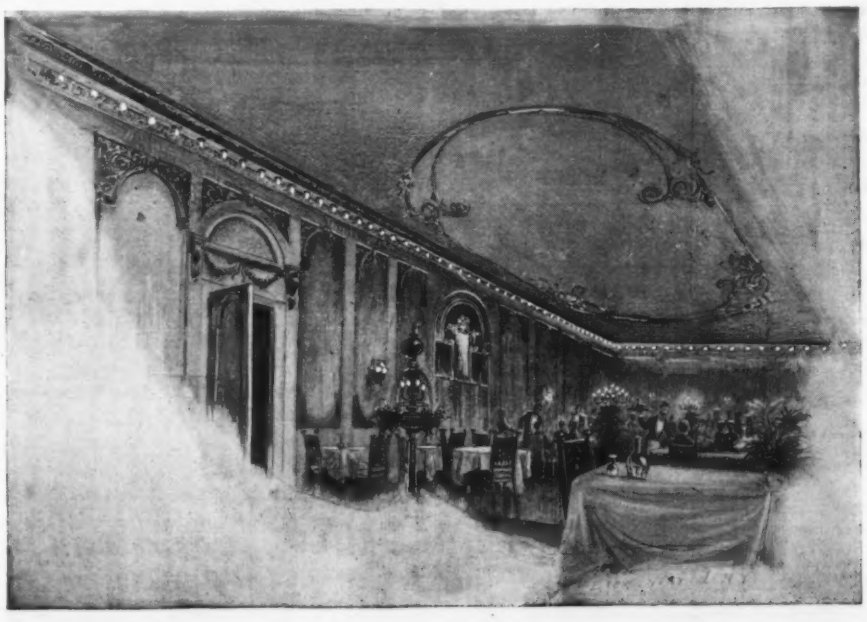


FIG. 2.—CEILING OF THE DINING-ROOM OF THE IMPERIAL HOTEL.

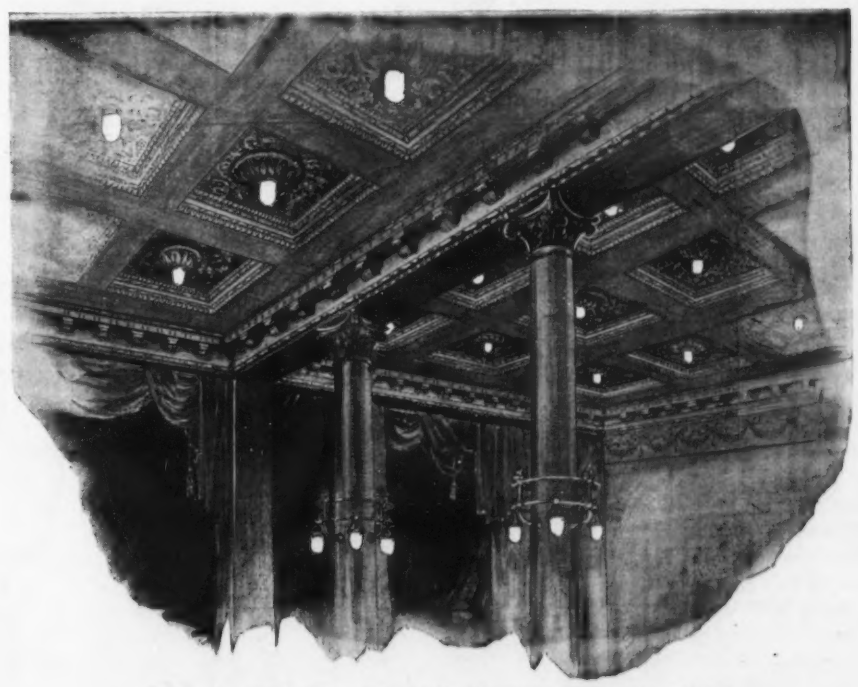


FIG. 3.—CEILING OF THE MARLBOROUGH CAFE.

The effort of the architect was to secure an absolutely even diffusion of light, and he has admirably succeeded. The decorations of the room are white and gold, and this beautiful effect would have been lost were chandeliers of any description used. The architect divided the ceiling into sections, allotting to each its portion of the light. The result is to make each unit of more service in adding to the general effect.

In the garland of light which marks the border we find an excellent specimen of the recent craze for combining electric light with floral decorations. The deep ceiling panels form an excellent background for the rather plain flexible pendants; but the result shows how highly artistic the simplest design can be made.

Rules of the Department of Electricity.

Rule I.—Applicants for space in this department are requested to furnish the following information as nearly as possible:

(1). A drawing to the scale of ¼ inch to the foot, showing size of space desired and general distribution of articles to be exhibited, also aisles (if any) among exhibits. Express length, breadth, etc., in feet and inches.

(2). State whether current for motors, lamps or other devices is required, specifying quantity and potential in volts and ampères.

(3). If power for operating machinery is required, state number of horse power wanted.

The above information is absolutely necessary for the proper allotment of space.

Rule II.—Applicants accepting space must agree to occupy it in accordance with the rules and regulations, except when special arrangements are made in writing with the Chief of the Department, and are requested to give earliest possible notice if they decide not to exhibit. Whenever exhibits will admit, the exhibitor is requested to display in glass cases.

Rule III.—No exhibitor can exhibit in other than his own space without obtaining the written permission to do so from the Chief of the Department.

Rule IV.—No exhibitor will be allowed to arrange his exhibit in a way to occasion inconvenience or affect the display of other exhibitors.

The Chief of the Department reserves the right to order any change in the design or arrangement of exhibits in the interest of harmony or the protection of other exhibitors.

Rule V.—The floor of the Electrical Building is designed to sustain a weight of 150 pounds per square foot. Any exhibit requiring an extra support in the judgment of the Chief of Department must be furnished with satisfactory support or foundation at exhibitor's expense.

Rule VI.—All exhibits of dynamos and dynamical current generating apparatus intended for operation with full or more than a very small percentage of their full capacity will be located in Machinery Hall, and will be placed in practical operation for transmitting current to the Exposition buildings.

Applicants for space desiring to offer their exhibit of dynamos and generators, etc., for the service of the Exposition for lighting the grounds and buildings, for artistic effects, or for furnishing power to the various departments, should communicate with the Director-General as early as possible.

Rule VII.—All platforms, railings, counters, signs, partitions and show cases must be erected at exhibitor's expense and shall not exceed dimensions given below. All designs for the above, with location of same in exhibitor's space, must be submitted to the Chief of the Department for his written approval before installation is begun.

Show Cases shall not be higher than 15 feet above the floor of the main aisles.

Counters shall not be higher than 2 feet 10 inches above the floor of the main aisles.

Railings may be erected, but must be of a uniform height of 2 feet 6 inches and subject to the approval of the Chief as in *Rule VIII.*

Platforms will be allowed only in certain parts of the building. All exhibitors wishing platforms to cover their space must build them to a uniform height of 8 inches.

Partitions will be allowed only in certain parts of the building and in all cases must not exceed 15 feet in height and must be approved in writing by the Chief of the Department before their erection is begun.

Signs must be ornamental in character and designs for same must be submitted to the Chief of the Department for his written approval. No signs will be allowed to extend beyond the limits of exhibitor's space, nor will signs of muslin, linen, canvas or paper be accepted. The Chief of the

Department will have the right to order down any signs that may be in an objectionable location, or may disadvantageously affect the appearance of the general exhibit.

Rule VIII.—All exhibits of machinery in motion must be protected by ornamental railings of a uniform height of 2 feet 6 inches; and all designs for railings must be submitted to the Chief of the Department for his written approval.

Rule IX.—No fire will be allowed in the Electrical Building except by the written permission of the Chief of the Department; oils and inflammable material will be allowed only in quantities sufficient for one day's use; suitable storage will be provided for the same.

Rule X.—Exhibitors requiring power in the Electrical Building will have to furnish the necessary countershafting, pulleys, hangers, etc., at their own expense. Electric motors will be allowed for moving machinery in this building and must be furnished at the expense of the exhibitor. Shafting and motors will be under the care of the exhibitor requiring them, but can be erected only on receipt of a permit from the Chief of the Department. Exhibitors must arrange their exhibits in such a manner as to require a minimum amount of shafting by using motors connected or belted to their machinery direct.

Rule XI.—Exhibitors may employ watchmen to take care of their machinery and exhibits at night, but such watchmen will be subject to the approval of the Chief of the Department.

Rule XII.—Exhibitors will be required to have their space clean and all rubbish swept into the aisles within one hour after the close of the Exposition at night. In cases where this rule is not complied with, the work will be done by the department and charged to the exhibitor. No sweeping will be allowed during the Exposition hours.

Fig. 8.—Entrance Light Corner Lenox Avenue and 119th Street.

Rule XIII.—The distribution of cards, circulars, pamphlets or samples about the building or its vicinity will not be permitted under any circumstances. Exhibitors can distribute such articles only from their own space, but will not be allowed to solicit their acceptance.

Rule XIV.—The arrangements and erection of electric conductors in all parts of the building shall be wholly under the supervision of the Chief of the Department, whose directions must be followed and whose decisions shall be final.

Rule XV.—Exhibitors will be required to attach to each exhibit a printed or type-written description in the English language, of the use and operation of the object exhibited, for the information of the public.

Rule XVI.—Exhibitors or their agents will be furnished by the department with duplicate cards, upon which must be the name or description and the catalogue number of each article entered for exposition. These will be countersigned on receipt of articles into the Exposition. One of these cards shall be conspicuously attached to the article described, and the other to be retained by exhibitor, to serve as his order for the article at the close of the Exposition.

The Department of Electricity reserves the right to amend these rules whenever it may become necessary.

Electric Fixtures for Exterior Illumination.—II.

It is particularly fitting that the Electric Club of New York should be the possessor of everything that electrical ingenuity and artistic skill can give it by way of illustrating the progress of the work to which its members are devoted, and in fact this is eminently the case. No finer example can be cited than the fixture at the very threshold of the club house. Above the portals is a bracket fixture consisting of an elaborately wrought spherical lantern of glass and delicate iron work, and perched upon it a watchful griffin. It is not a large fixture but one particularly attractive from the finish of the design and the beautiful execution of the metal work. It was furnished by Thackara & Co., of Philadelphia, and is one of the most finished specimens of the smaller exterior electroliers to be found in the city. Brilliant with incandescent lamps in the

Fig. 9.—Bracket Lantern, 39th Street and Fifth Avenue.

evening it attracts attention at a glance and well repays a close and thoughtful examination.

There is at the present time really very little excuse for inartistic fixtures with all the wealth of designing skill, material and working facilities that can be commanded. Of course the exterior of an ordinary house does not present an opportunity for elaborate display in the way of lighting effects at all commensurate with that which can be obtained in great hotels and apartment houses, or in the towering street fixtures described in the former part of this article. It is, however, quite possible to design perfectly harmonious and tasteful fixtures suitable for entrances and vestibules which shall be no less beautiful, although far smaller and more suited to ordinary needs. This electric club fixture of which we have been speaking is a good typical example of such practice, and one that well deserves to be followed in very many places. For this class of work, too, where the amount of material forms an unimportant factor in the general expense, a greater diversity of metals than can be employed in very large fixtures is available; for instance, aluminium, aluminium bronze and all the infinite

Fig. 10 and 11.—A Pair of Bracket Lanterns.

variety of colored bronzes for which Japanese art is preeminently distinguished, can be displayed to the greatest advantage in such situations, and we hope to see these alloys introduced far more freely in fixture work than has been the custom heretofore. There is no need whatever for confining one's self to brass, ordinary bronze, copper and iron, and it would be far better to extend the range of material and thus obtain color effects as well as form effects.

A design of severe, almost archaic simplicity, and yet most symmetrical and harmonious, is to be found in the bracket lantern that lights the portal of the old Dutch Reformed Church at Thirty-ninth street and Fifth avenue. It is a wrought iron fixture made by the firm of Messrs. E. P. Gleason & Co., that is responsible for not a few of the graceful exterior fixtures in this city. On a modern house front it would seem out of place, but on the old church wall, with Virginia creeper twining about its base, the form seems singularly appropriate. A bunch of incandescent lights within a paneled glass lantern casts a cheerful light directly down and over the doorway and gate. It is really a gem in its way and derives no little of its effectiveness from the artistic instinct that subordinated the elaboration of metal work to harmony with the surroundings. There is now and always has been in fixture making too strong a tendency to consider only the forms in which a given amount of metal is to be worked, forgetting sometimes that there are circumstances when the most beautiful and ornate design would be thoroughly out of place and detract from, instead of enhance, the general effect desired to be produced.

An exterior electrolier of a widely different character, but singularly effective in the situation in which it is employed, is the tall entrance light at the residence on the corner of 119th street and Lenox avenue. It is borne on a pedestal of mosaic six feet high, itself an object of art well worth more than a cursory glance. Above it rises a spear-tipped slender column of polished brass, around which is coiled a great bronze dragon whose jaws are closed upon

Fig. 12.—Fixture at the Entrance to the New York Electric Club.

the ring from which the lantern depends. This is oval in form, of antique brass and cut glass, through which at the approach of nightfall incandescent lamps blaze out, illuminating the entrance. It is one of the best of the suspended lantern form of fixtures we have yet seen and reflects great credit on the designer of Messrs. Schneider, Campbell & Co., who made it. The total height of the fixture and pedestal is 11 feet, and the general effect is most admirable. New York above Central Park contains much in the way of decorative modern houses, fine entrances and novel architectural effects, but there is little better in its way than this particular portal on Lenox avenue. The scope of the designer's art is almost unlimited just at present, as indeed has been suggested by what has already been said of fixtures. The tendency runs toward the grotesque forms in bronze and more especially in wrought iron, taking a hint perhaps from the fame of old Nuremberg in that particular branch of metal working the reputation of which has come down from the Middle Ages, and deservedly, if one may judge from the specimens still existing in that venerable city. The griffin has been the special favorite in designing fixtures for interior lighting, and a couple of additional excellent examples of its use may be seen in Figs. 10 and 11. Both of these are small lanterns for entrances and exhibit widely different styles of treatment, starting from the same griffin idea. The first is a pattern devised by R. Hollings

& Co., of Boston; the second was sketched by one of the clever New York designers. The same theme is treated in both; in the first the griffin is very conventional in form and bears an elaborately decorated dependent lantern especially appropriate for an entrance light; the second is suited for use on a somewhat larger scale, or, if necessary, for a combination fixture; in it is employed an ornamental bracket bearing both a dependent and an erect lantern, one of them—the lower—a globe fancifully decorated, the other a severely simple lantern shown holding a bunch of incandescent lamps, a combination admirably suited for the use of gas in the upper lantern if desired. Around the bracket is twined a nondescript monster somewhat reminiscent of a sea serpent and emerging from a supposititious aperture at the top of the bracket. Both these small lanterns are of thoroughly artistic form and are suited to somewhat different architectual surroundings.

Standing at the Fifth avenue entrance of Central Park the eye is immediately attracted to the magnificent new Plaza Hotel blazing with light and towering above its surroundings. perhaps the finest specimen of hotel architecture in the city. It is very completely and artistically lighted throughout with electricity, but glancing at its front, the first thing noticed by the observer would be the four huge bracket fixtures that shoot out from its front half way across the sidewalk; two of them are shown in our cut, Fig. 13, and they certainly are immensely striking, both from the general harmony of the effect and the intrinsic gracefulness of the fixtures themselves. They are probably the largest exterior fixtures ever manufactured in this country at least. It is needless to say that they are of the most massive description, great curved tubes of wrought iron forming the supporting members and built into the front wall with the greatest solidity. Indeed, solidity is absolutely necessary here, for they reach a dozen feet from the wall, and the five lanterns that each bracket bears are large and elaborately decorated with artistic ironwork. Each bears a bunch of lamps, setting the whole lower front of the hotel aglow with brilliant light. The lanterns are perhaps the most decorative part of the fixture, the effect of the main bracket being obtained principally from its massive curves. The lanterns are paneled with plate glass, with lines of wrought iron shooting upward, suggesting the outlines of some purely conventional flower forms. These huge fixtures are from the workshop of John Williams, of New York, and aside from the artistic skill necessary in their designing the manufacture of such colossal pieces of ornamental metal work, was a task itself of no small magnitude. So unique in appearance and size are these fixtures that it will repay the reader who is convenient to the locality to stroll by the Plaza Hotel in the evening that he may better appreciate the remarkable results that have been reached.

FIG. 13.—BRACKET LANTERNS IN FRONT OF THE PLAZA HOTEL.

Belonging to a totally different order of electroliers is the fine newel post light seen in Fig. 14; it is not a New York fixture, like most of those we have described, though furnished by Mitchell, Vance & Co., a New York house; it is one of the contributions of metropolitan art to the architectural features of the Windy City, and stands at the entrance of the residence of Ferdinand Peck, Esq., of Chicago. It is pre-eminently a newel post light, and in fact the pedestal is entirely of polished wood clasped about the top and down the four sides by the supports of the fixture proper. This is of forged copper beautifully wrought, a somewhat unusual and very beautiful material for this class of work.

In the general design of the fixture we find the griffin idea that has already become familiar, although much modified and in an exceedingly conventional form. The chief beauty of the fixture lies in the excellent adornment of the lantern itself, a globe of delicately tinted glass held in position by a daintily elaborate lace work of metal so designed that the light within glows through almost as it would through textile lace, giving a particularly warm and cheerful aspect to the vestibule by which it stands. In conception and execution it is the peer of any that we have thus far noted, and indeed is almost unique as a specimen of especially excellent design and workmanship.

Coming back to the metropolis again and to Fifth avenue, which is, or was, the heart of New York, and moving up town according to the habit of the modern New Yorker, who finds the downtown part of the avenue too afflicted with trade to suit his fancy, we find at the corner of Fifth avenue and Eighty-fifth street another newel post fixture as modern as some of those previously described have been mediæval. It is beautiful, nevertheless, with an exuberance of twisted wrought iron, admirably shown in Fig. 15. One can in imagination fancy a certain faint resemblance to the Eiffel Tower in its general structure, though the fine globular lantern at the top serves to partially dispel the illusion. It is from the workshop of I. P. Frink, of New York, and like most of the others we have referred to is wholly of wrought iron, at present apparently the favorite material for exterior electroliers. And so we might go on through this and other cities, picking up here and there an artistic gem of modern style replacing the venerable gas fixtures that have so long made night artistically hideous wherever they have found lodgment. To the making of fixtures there is no end—good, bad and indifferent, can be found on every side. Very many of the more recent ones are emphatically good, and since the design has ceased to be subordinated to the conditions compelled by the use of gas as an illuminant, the proportion of good to bad fixtures is likely to increase very noticeably. We might fill page after page with cuts of fixtures scarcely less beautiful than some that we have shown, but the task at the present rate of expansion of the art would be endless, so that we are compelled to summarily draw these descriptive notes to an end. They will have served their purpose if they but show the wonderful adaptability of electric illumination and the marvelous facilities it gives for the production of illumination artistic beyond the wildest dreams of even our immediate predecessors. As the use of the electric light becomes more and more general from year to year, the illuminative art will grow with the necessity for it, gradually spreading beyond the traditions of candle and gas and striking out along new lines in the search for artistic effects of every sort.

FIG. 14.—NEWEL POST LIGHT OF A CHICAGO RESIDENCE.

FIG. 15.—NEWEL POST LIGHT, 5TH AVENUE AND 85TH STREET.

Electric Lines in Galveston.

President Wm. H. Sinclair, of the Galveston (Tex.) City Railroad Company, has recently returned from the East. He refers to his experience in the East and his belief in electric traction as follows, in a recent issue of the Galveston *News:*

"I had two important objects in view on my recent absence from the city. One was to place the new bonds that we are about ready to issue, with which to pay for electrical equipments and the reconstruction of our various lines, and the other was to attend the meeting of the American Street Railway Association and purchase the balance of the material needed for the rebuilding of the balance of our lines of track.

"The meeting of the street railroad convention at Pittsburgh was one of the most interesting and instructive that the association has yet had. Everything was electricity. Nothing else was discussed. Mules, horses, cables, compressed air for motive power, etc., were barely discussed at all, and were so completely overshadowed by 'the imponderable agent that prevades the material world and is visible only in its effects,' as our philosophy used to teach us electricity was, and is to-day, that in the language of Nic McLemore last Spring when we started the first electric cars, neither mules, horses, cables or anything else were in it.

"The rapid strides made in electrical propulsion during the past year are wonderful, and the end is not yet. Last year the single reduction motor was just coming to the front. This year the gearless is out. I presume that you are aware, and if not I will tell you, that as yet only about half of our lines are equipped electrically. I have while north closed contracts for 1,000 tons of steel rails, 25 new motors and car bodies of the latest type and design, and I expect to finally say goodby to the festive mule on every foot of our lines by the 1st of next May.

"You know that equipping electrically means the complete building or rebuilding of roadbeds, for without the best of tracks it is almost impossible to operate electric cars. When the Galveston City Railroad Company commenced equipping electrically we had nothing but our franchise. Yet it pays us and it pays every street railroad company to incur the extra expense the reconstruction and rehabilitation involves. No road has changed its equipment without undergoing an experience similar to ours, and which involves many trials and tribulations. Yet I failed to meet one street railroad man at Pittsburgh who regretted the step he had taken and the change in course of inauguration. Every day brings the various systems nearer to perfection in simplicity, durability and economy, and every day the electrical and mechanical defects are being reduced nearer to a minimum. In order to complete our electrical equipment and the reconstruction of our road we shall have to expend about $100,000 yet, making a total of $400,000 we have spent in this work. Already we have expended about $300,000."

(*Copyrighted, 1890.*)

Chronological History of Electricity, Galvanism, Magnetism and the Telegraph, from B. C. 2637 to A. D. 1888.—Part I.*

BY P. F. MOTTELAY.

The many valuable experiments made by Coulomb on the dissipation of electricity and upon the distribution of electricity solely upon the surfaces of bodies are fully recorded in the able article of Sir David Brewster in the *Britannica*. (See F. C. Achard (Mém. de Berlin," 1780, p. 47); M. Vernier, "De la dist. . . . conducteurs," Paris, 1824; J. L. F. Bertrand, "Programme d'une thèse . . ." Paris, 1839; D. Bourdonnay, "Sur la dist. . . . conducteurs," Paris, 1840; Ed. A. Roche ("Montp. Acad. Sect. Sciences," vol. II., p. 115.)

He discovered that shellac is the most perfect of all insulators, also that a thread of gum-lac insulates ten times better than a dry silken thread of the same length and diameter: and he established the general law that the densities of electricity insulated by different lengths of fine cylindrical fibres, such as those of gum-lac, hair, silk, etc., vary as the square root of the lengths of the fibre.

Besides the papers above alluded to, Coulomb communicated to the French Academy, during the years 1786, 1787, 1788 and 1789, many papers upon Electricity and Magnetism, and, up to within two years of his death (1806), he made many notable experiments, especially in magnetism, of which full accounts are given in several of the Mémoires noted at foot. The theory of the two magnetic fluids appeared in his 1789 paper. It is also in this same paper that Coulomb describes his improved method of making artificial magnets, by employing compound magnets as first made use of by Gowin Knight (A. D. 1746). Still further improvements in these were brought about more particularly by the young Flemish scientist, Etienne Jean Van Geuns (1767–1795), by Jean Baptiste Biot (A. D. 1810), and by the Rev. Dr. Scoresby (A. D. 1836).

He finds that a steel wire is, by twisting, made capable of being nine times more strongly magnetized ; that the magnetic power dwells on the surface of iron bodies and is independent of their mass ; that the directive force of a magnetized bar reached its maximum when tempered at a bright cherry red heat at 900 degrees, and that every substance is susceptible of magnetism to a degree of actual measurement. This last important research was communicated by him to the French Institute during the year 1802. His experiments proved that a grain of iron could communicate sensible magnetism to twenty pounds weight of another substance, and that when even beeswax had incorporated with it a portion of iron fillings equal only to the one hundred and thirty thousandth part of its weight it was yet sensibly affected by the magnet.

According to Dr. Thomas Young, Coulomb's improvements in the theory of electricity may be considered as having immediately prepared the way for the elegant inventions of Volta and for the still more marvelous discoveries of Davy. Dr. Young gives reports of some of Coulomb's experiments at p. 439, vol. II., of his "Course of Lectures," London, 1807. ("Journals of the Royal Institution," vol. I., p. 134; "Décade Philosophique," No. 21.)

See "Mém. de l' Acad. Royale des Sciences," Paris, 1784, p. 266; 1785, pp. 560, 569, 578, 612; 1786, p. 67; 1787, p. 421; 1788, p. 617; 1789, p. 455; "Mém. de l'Institut," vol. III., p. 176; vol. IV., p. 565, and vol. VI., for 1806; "Mém. de Math. et de Phys.," vols. VIII. and IX.; "Bull. de la Soc. Philom.," Nos. 3, 31, 61, 63, and for 1795, 1802; *Journal de Physique*, vols. XLV. (II.), pp. 235, 448; LIV., pp. 240, 267, 454; LV., p. 450 (for Corradori's report); Ch. N. A. De Haldat de Lys. ("Mém. de Nancy," for 1841); *Phil. Magazine*, vols. XI., p. 183; XII., p. 278; XIII., p. 401; XV., p. 186; Rozier, XXVII., 116; XLIII., 247; Gilbert, XI., 254, 367; XII., 194; Dr. Young, "Course of Lectures," London, 1807, vol. I., pp. 682, 685, 686; "Royal Society Cat. of Sc. Papers," vol. II., p. 73; Eighth "Britannica," vol. XIV., pp. 37–38; Humboldt, "Cosmos," 1859, vol. V., p. 61; Schaffner, "Manual," 1859, p. 56; Biot's article in the "Biographie Universelle" and Biot's "Traité de Physique," Paris, 1816, vols. II., III.; Dr. Thomas Thomson, "Outlines of the Sciences, etc.," London, 1830, pp. 350, 351, 379–422; Harris, "Rudim. Magn.," Parts I., II., p. 56. See, also, description of the electrometer of Colardeau and the electro-micrometer of Delaunay, in the latter's "Manuel, etc.," Paris, 1809, pp. 66, 76–80, and plate V., fig. 61, as well as Libe's "Dict. de Phys.," vol. I., p. 406.

A. D. 1785.——The Canon Gottoin de Coma, friend of Alessandro Volta, observes that an iron wire about thirty feet in length will give a sound under certain conditions of the atmosphere when stretched in the open air. The circumstances that accompany, as well as those that favor the production of the phenomenon, says Prescott, demonstrate that it must be attributed to the transmission of atmospheric electricity. This transmission, in fact, does not occur in a continuous manner, like that of a current, but rather by a series of discharges.

See Knight's *Mechanical Dictionary*, 1876, vol. III., p. 2,515; Prescott's "The Speaking Telephone, etc.," 1879, p. 122; *Encyl. Britannica*, 1860, vol. XXI., p. 631.

A. D. 1785.——According to Prof. Tyndall, George Cadogan Morgan sought to produce the electric spark in the interior of solid bodies. He inserted two wires into wood and caused the spark to pass between them ; the wood was illuminated with blood red light or with yellow light according as the depth at which the spark was produced was greater or less. The spark shown within an ivory ball, an orange, an apple, or under the thumb, illuminated these bodies throughout. A lemon is especially suited to this experiment, flashing forth at every spark as a spheroid of very brilliant golden light. A raw of eggs is also brilliantly illuminated throughout, at the passage of every spark from a Leyden jar.

Mr. Morgan likewise made several experiments to ascertain the influence of electricity on the animal functions. These are alluded to at page 602, volume VIII., of the 1855 *Britannica*, and at page 49 of *Electricity* in the "Library of Useful Knowledge."

George Cadogan Morgan (1754–1798) was an English physician and also a professor of natural philosophy at Hackney, in an establishment founded by his uncle, Dr. Price. His "Lectures on Electricity" appeared in Norwich during the year 1794. In the second volume he describes (pages 225–236) "the form, noise, colors and devastation of the electric flash," and treats (pages 383–397) of the "relation of the electric fluid to vegetation," alluding more particularly to the experiments of Maimbray, Nollet, Achard, Duvernier, Ingen-Housz, Van Breda, Dr. Carmoy and the Abbé d'Ormoy. He likewise gives an account of the northern lights as well as descriptions of Bennet's movable doubler and electroscope and of Lane's electrometer.

See his biography in Larousse, "Dict. Universel," tome XI., p. 562, and in "Biog. Générale," tome XXXVI., p. 570.

A. D. 1786.——Rittenhouse (David), an American physicist and astronomer who afterward became F. R. S. and succeeded Dr. Franklin as president of the Am. Philos. Society, publishes his theory of magnetism in a letter to John Page at Williamsburg, which is reproduced at folio 178 of vol. II., old series, of the Transactions of the above named society.

"Were we called upon," says Renwick, "to assign him a rank among the philosophers whom America has produced we should place him, in point of scientific merit, as second to Franklin alone."

See "Trans. Am. Soc. of Phila.," Old Series, vol. II., pp. 173, 175, for Page and Rittenhouse, and vol. III. for Rittenhouse and Jones as well as Rittenhouse and Hopkinson upon Meteors and Lightning.

A. D. 1786.——Galvani (Aloysio or Luigi), an Italian physician, who, at the age of twenty-five, was professor of anatomy at the University of Bologna, is led to the discovery of that important branch of electricity which bears his name. The manuscript giving the result of his experiments upon the Electricity of Metals is dated Sept. 20, 1786.

From papers in the "Bolognese Transactions," noted below, it would appear that he had, even before the year 1780, made many observations on the muscular contraction of frogs by electrical agency. Upon one occasion his wife happened to be holding a scalpel against the dissected legs and parts of the spine of a frog, which lay in close proximity to the conductor of an electrical machine recently charged by one of Galvani's pupils. She noticed that whenever the dissecting knife touched the muscles they were violently convulsed, and, upon communicating the fact to her husband, he repeated and extended the experiment and found it necessary to pass the electric fluid through a metallic substance in order to develop the result first observed. At first the frogs had been hung upon a copper hook fastened to an iron railing, but, for these, he afterward substituted an arc composed of both metals and with which he could readily produce the same results as were obtainable with an electrical machine.

Galvani also made experiments to ascertain the effect of atmospheric electricity upon the nerves of frogs. He connected the latter with rods leading to lightning conductors erected upon the roof of his house, attaching also round wires to the legs of the animals, and found that the same violent convulsions appeared whenever lightning was seen and likewise when heavy storm clouds passed over the house.

The results of his many interesting observations were first made public in the celebrated work, entitled "Aloysii Galvani de viribus electricitatis in motu musculari. Commentarius cum Aldini dissertatione et notis," which appeared during 1792. Therein, he expressed the belief that the bodies of animals possessed a peculiar kind of electricity by which motion is communicated through nerve and muscle, positive electricity going to the nerve, while negative electricity goes to the muscle, and that the muscles represent the exterior and the nerves the interior of the Leyden jar, the discharge being similarly produced by the metal which communicates with both.

Galvani's singular experiments naturally attracted everywhere the attention of philosophers, by whom they were repeated and varied, but by none were they more assiduously prosecuted than by Volta, who was then a professor at the Pavia University, and who, as already indicated (A. D. 1775), was led by them to the discovery of the voltaic pile and of voltaic or galvanic electricity.

The announcement of Galvani's observations was made in Germany, notably by J. F. Ackermann ("Medicinisch-chirurgische Zeitung"), by M. Er ("Physiologische Darstellung der Libenskrafte"), by M. Smuck ("Beiträge zur weiteren Kenntniss, etc."), and by F. A. C. Gren ("Journal der Physik," vols. VI., VII., and VIII.), while experiments were continued upon an extensive scale by the Italians F. Fontana, Carlo Francesco, Bellingeri, M. Giulio and F. Rossi, as well as by Samuel T. Von Sommering, by Wilhelm Behrends and by Karl Friedrich Kielmayer (Kielmaier), Professor of Medicine at the Tubingen University (Poggendorff, vol. I., page 1,253). For the curious galvanic experiments of the celebrated French physician Larrey, and of Stark, Richerand, Dupuytren and Dumas, see "Bulletin des Sciences de la Société Philomathique," 1793, Nos. 23, 24, and "Principes de Physiologie," vol. II., page 312.

See also, C. Alibert, "Eloges Historiques de Galvani, Spallanzani, Roussel et Bichat . . .," Paris and Bologna, 1802-1806 ("Mém. de la Soc. d'Emul. de Paris," vol. IV.; S. Gherardi, "Rapporto sui Manoscrotti," Bologna, 1840, p. 19); Poggendorff, vol. I., p. 839; Thomas Thomson, "History of the Royal Society," London, 1812, pp. 450, etc.; Thomas Young, "Course of Lectures," London, 1807, vol. II.; "Bolognese Transactions" for papers dated April 9, 1772, April 22, 1773, and Jan. 20, 1774; Sabine, "El. Tel.," 1872, pp. 16-18; Knight's "Mech. Dict.," vol. II., pp. 936, 937, for extract from report of Nat. Inst. of France, July 4, 1798; "Johnson's Encyclop.," 1877, vol. I., p. 1,510; Bakewell's "Electricity," p. 26; "Encyclop. Britannica," 1855, vol. VIII., p. 530, and vol. XXI., p. 609, etc., Fahie's "History, etc.," 1884, pp. 180-185; *Phil. Trans.*, 1793; Miller, "History Philos., III.," London, 1849, vol. IV., p. 333; Thomson, "Hist. of Chemistry," vol. II., pp. 251, 252; Matteucci, "Traité des phénomènes, etc.," part I., p. 7; the address of Mr. Gavarret made in 1848 before the Paris Medical Faculty; J. C. I. A. Creve's treatise on Galvanism ("Jour. de la Soc. de Méd.," vol. 18, p. 216); "Mém. de la Soc. Méd. d'Emul.," vol. I., p. 236); Biot et Cuvier (*Ann. de Ch.*, vol. 39, p. 247); A. Richerand ("Mém. de la Soc. Méd. d'Em.." vol. III., p. 311); "Opus. Scelt.," vol. XV., p. 113; "Giornale Fis. Med.," vol. II., pp. 115, 131 (letter of B. Carminati); Marsiglio Landriani, "Lettera, etc.," 1776; Lettre d'un ami au Comte Prosper Albo ("Bibl. de Turin," 1792, vol. I., p. 261; *Jour. de Phys.*, tome XLI., p. 57); "Comment Bonon. Scient.," vol. VII., p. 363; account of the experiments made by MM. Cortambert and Gaillard, reported in "Mém. de la Soc. Méd. d'Em.," vol. I., pp. 232, 235; G. Klein's "Dissert. de Métal, etc.," Maintz, 1794; C. H. Wilkinson, "Elements of Galvanism, etc.," London, 1804, 2 vols. *passim;* Wm. C. Wells, "Obs. on the Influence, etc." (*Phil. Trans.*, 1795, Pt. XI., p. 246); E. G. Robertson (*An. de Ch.*, 1801, vol. 37, p. 132; *Jour. de Paris*, 10, 15 and 17 Fructidor de l'An. VIII.); Paul Louis Simon, "Beschreibe neuengalvanisch, etc.," "Resultate, etc.," and "Versuche, etc.," all published in 1801 (L. W. Gilbert's *Annalen*, 1801, 5th Book; *An. de Chimie*, No. 121, p. 106); L. W. Gilbert's 6th Book of the *Annalen*, containing the Memoirs on Galvanism by J. L. Boeckmann, L. A. Von Arnim, Paul Erman, M. Gruner and C. H. Pfaff; C. Dupuytren, "Faits Particuliers, etc." 1801; J. B. Tromnsdorff, "Expér. Galv." 1801; M. Rouppe's letter of Aug. 28, 1801, in Van Mon's *Jour. de Ch.*, Vol. I., pp. 106, 108; M. Bichat (Sue., "Hist. du Galv.," II., p. 216); A. M. Vassali-Eandi (*Jour. de Phys.*, Frimaire, An. X., p. 476); C. F. Hellwag and Mr. Jacobi fils, "Erfahrungen, etc.," 1802; Mr. le Comte de Pusckin's experiments on Galvanism, made Sept. and Dec. 1801, with a *colonne tournante* (P. Sue, ainé, "Hist. du Galv.," vol. II., pp. 257, 258).

Consult, likewise, Al. Volta, in *Jour. de Leipzig*, and in "Comment . . . Med. gestis," 1792; Johann Mayer, "Abh . . . Galvani, Valli, Carminati u. Volta . . . ," Prag, 1793); Junoblowiskiana Society ("Comment . . . Med. gestis," 1793); Mr. Cortembert ("Mém . . . Soc. . . . d'Emul.," I., p. 232); Mr. Payssé ("Jour. de la Soc. des Pharm.," first year, p. 100); Geo. Couvier (*Jour. de Physique*, vol. VII., p. 318; "Mém. des Soc. Sav. et Lit," vol. I., p. 132), 1801; Mr. Mathieu ("Rec. de la Soc. d' Agr. . . . d' Autun," An. X., p. 21), 1802; Ponton d'Amécourt, "Exposé du Galvanisme," Paris, 1803; Joseph Weber's works, published in 1802-1803, 1815, 1816, and those of J. K. F. Hauff, Marburg and Leipsic, 1803, 1804; Mr. Curtet (*Jour. de Van Mons.*, No. VI., p. 272; *Jour de Physique*, An. XI., p. 54), 1803; William Meade ("On the origin and progress of Galvanism"), Dublin, 1085; J. C. Reil (*Jour de Van Mons.*, No. IV., p. 104; Sue. "Hist. du Galv.," vol. IV., p. 26); J. A. Heidmann (*Phil. Mag.*, vol. XXVIII., p. 97), 1807; Sir Richard Phillips, "Electricity and Galvanism explained . . . ," (*Phil. Mag.*, vol. LVI., p. 195), London, 1820; B. G. Sage, "Recherches . . . Galvanisme"; Leopold Nobili, "Sur le courant. . . . " Genève, 1827.

A. D. 1787.——Lomond—Lomont—(Claude Jeane-Baptiste), a very capable French machinist, and "one who has a genius for invention," is the first to introduce a successful electric telegraph consisting of but one wire. Of this the following account appears under date Oct. 16, 1787, in Arthur Young's "Voyage Agronomique in France" ("Travels"), fourth edition, vol. I., p. 79: "You write two or three words on a paper; he takes them with him into a room and turns a machine in a cylinder case, on the top of which is an electrometer having a pretty little ball of pith of a quill suspended by a silk thread; a brass wire connects it to a similar cylinder and electrometer in a distant apartment, and his wife, on observing the movements of the corresponding ball, writes the words which it indicates. From this it appears that he (Lomond) has made an alphabet of motions. As the length of the brass wire makes no difference in the effect, you could correspond with it at a great distance, as, for example, with a besieged city or for objects of much more impor-

*Continued from THE ELECTRICAL WORLD of Dec. 5, 1891.

tance. Whatever be the use that shall be made of it, the discovery is an admirable one."

See Ed. Highton, "Elec. Tel.," 1852, p. 38; Sabine, "Elec. Tel.," pp. 10–11; Shaffner, "Manual," pp. 132, 133; Vail's "History, etc.," p. 121; "Appleton's Encycl.," 1871, vol. XV., p. 335.

Electricity in Mining.—III.

DRILLS.

The drill is the most universal of all mining appliances operated by power other than hand. It is in fact the keystone of the modern mining and quarry industries, and has come to be recognized as the only means by which mining work on a large scale can be accomplished.

Drills operated by steam and compressed air have for a long time been in operation; but the use of electricity for this work is of comparatively recent date.

The first electric drill constructed in the United States, in which the motor and drill were mounted on one support, was built in 1886 by Mr. William M. Schlesinger. Mr. Schlesinger was the first engineer to apply electricity to mining work in this country, he having had a long experience with similar work both in England and Germany. Mr. Schlesinger is now expert for the Edison General Electric Company.

This first drill, shown in Fig. 4, was installed in the anthracite coal mine at Lykens, Pa., 3,000 feet from the generating station. Although a very crude affair, it drilled at the rate of six feet in a minute and a half, and was in operation a very considerable length of time.

Following this came the Marvin percussion drill, invented by H. N. Marvin, of Syracuse, N. Y.; the Van Depoele percussion drill, developed by Mr. Chas. J. Van Depoele, and the Story diamond prospecting core drill, invented by Mr. I. E. Story, of Denver.

The electric drills thus far developed may be divided into three classes: (1) Percussion drills, using the solenoid principle; (2) diamond core drills, for prospecting work, and (3) rotary drills, employing the regular auger bit, for drilling in soft material.

PERCUSSION DRILL.

This is the most universal type of drill machines. Its principle is to disrupt, by a hammer blow, the hard substance which it encounters, repeating the blow with great rapidity and finally wearing away the stone. As with the ordinary hand drill, the power necessary is that which is required in driving the drill, it being pulled back to prepare for another blow. This is accomplished in the electric drill by the solenoid principle.

Briefly described, this consists of two separate coils of wire, one in front and the other in the rear of the drill. A steel plunger works through the centre of these coils, and really constitutes the drill rod. Three wires are run from the generator to the drill. One of these connects with the forward coils, the other with the rear, while the third acts as a neutral conductor. Let us suppose that the first impulse of the current magnetizes the forward coil. The bit is immediately pulled forward with great force. The current is now reversed and the rear coil is magnetized, while the forward becomes dead. This pulls the plunger back until it is pulled forward again by the next impulse of current in the forward coil. It is the most beautiful demonstration of electric power that has yet been developed, while at the same time it is the simplest. It reduces the necessary moving parts of the drill to simply one, the plunger, and secures the following advantages to the machine:

It is simple in construction and strong in every part.

It has but one moving part.

It takes up very little space.

The drill cannot damage itself by its own blow.

The length of the stroke is variable at will.

It has no joints to be fitted or packed.

It is not affected by heat, cold or moisture.

It is independent of the action of any valve.

The rotary motion is automatic.

It can be operated at great distances from the source of power.

It can be entirely taken apart and put together again inside of ten minutes.

The striking part is of relatively great weight, and it strikes directly.

The rate of striking is independent of the kind of material it strikes.

No loss is suffered due to elbows, bends, valves, etc., in the conductors.

It can be rapidly moved from one position to another at a great distance, since the energy is transmitted through flexible cables,

It is very light in weight for its strength, this being possible because of the perfect cushioning at both ends of the stroke.

It will operate in the open air without striking anything, and hence can be made to strike an extremely light blow at its full rate, which is very important in starting holes, etc.

The conductors can be carried on very light supports, both because of their light weight and because the transmission of energy through them does not tend to distort their position.

It is practically impossible to run the machine in such a way as to injure it.

In introducing the wires through the mine a simple expedient insures the certainty of unskilled persons always making right connections of the wires.

The importance of the above characteristics will be apparent to any one familiar with the operation of steam and air drills.

In pushing engineering work, it is frequently of paramount importance that the work be done quickly. Consequently, any means of greatly increasing the rate of drilling is extremely valuable. To do this we must either increase the strength of each blow, or else increase the number of blows per minute. A limit to the rate of striking is soon reached when a valve of considerable weight must be moved from rest by the concussion of the previous blow and when a material substance, such as steam or air, must then fill the space back of the piston and raise the pressure to working point. With the electric drill the speed of rotation of a perfectly balanced cylindrical armature of small diameter has no such limitations, and there is apparently no limit to the rate of striking, except the magnetizing and demagnetizing of iron, which is already done in daily commercial practice at the rate of 10,000 times per minute with the highest efficiency.

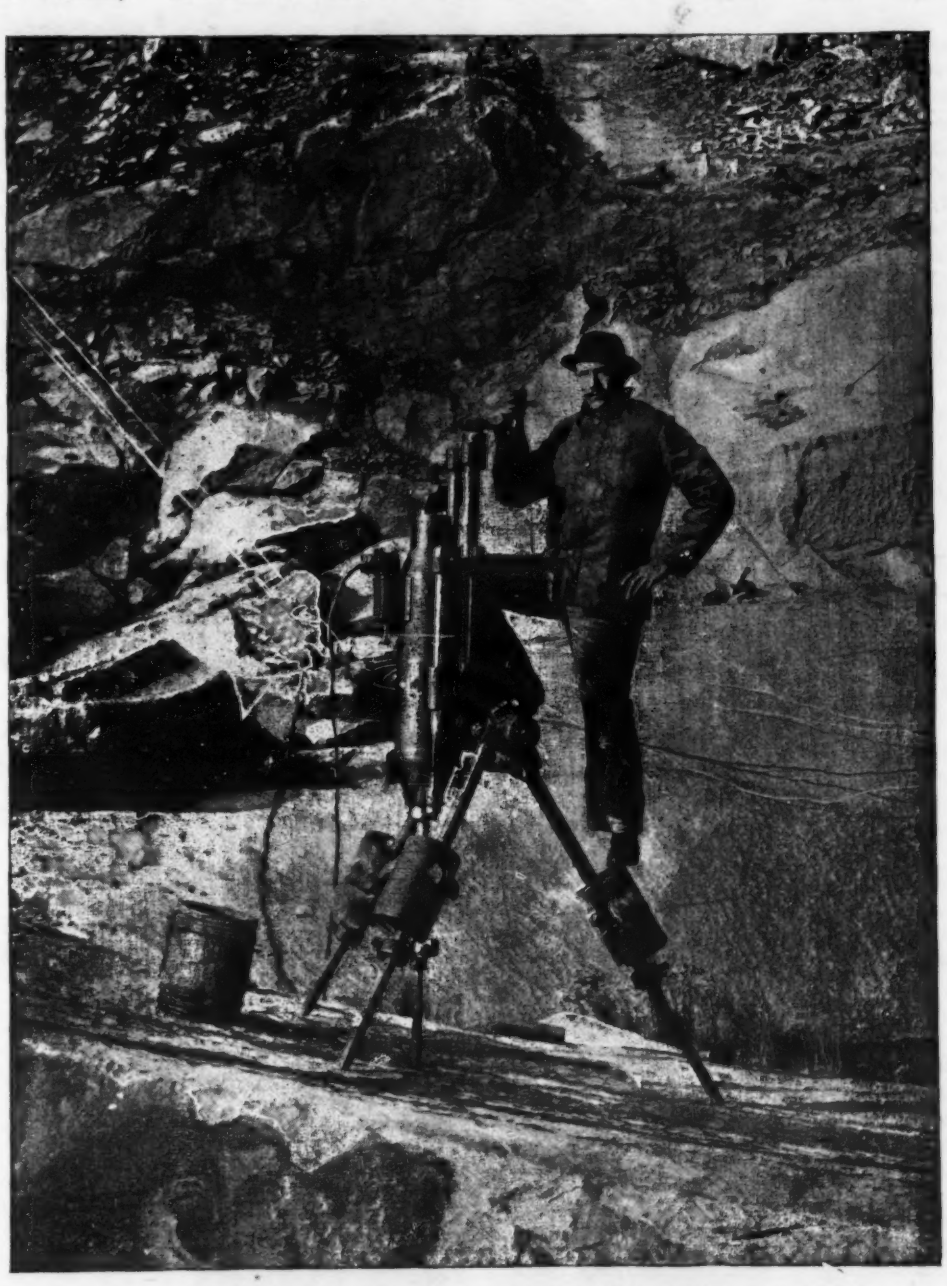


FIG. 1.—THOMSON-VAN DEPOELE PERCUSSION DRILL AT WORK.

The importance of rapid driving of work is practically illustrated by the fact that in driving the Sutro Tunnel Mr. Sutro offered the men at work, in addition to their regular wages, the following bonus:

For every foot per month over 300 and under 400	$ 5.00
For every foot per month over 400 and under 500	10.00
For every foot per month over 500	20.00

A bulletin from the Census Office, under date of March of this year, shows that in granite quarrying the cost of labor is 84 per cent. of the total cost of production, and in Massachusetts, where the output is much greater than in any other State, and where the longest experience and most approved methods are met with, the labor is 82½ per cent. of the total cost. It will be evident that any labor saving device in such a field will be extremely valuable.

Added to the advantages secured in the drill itself may be mentioned the superiority of the electric power for this work, a detailed discussion of which, in this connection, would be superfluous. As stated in the opening article of this series, it must be apparent to all that a simple copper wire, carrying no sensitive matter, is not only more flexible but more reliable and economical than any system of pipes yet devised. Then, again, the constantly shifting requirements of modern mine development make the use of electricity almost a necessity.

That the mining world has not been slow to appreciate the advantages of the electric drill is demonstrated by the wonderful strides these machines have made in the comparatively short time they have been in the field. Following will be found some interesting tests and data, reported by the promoters of these perfected drills.

Perhaps the first successful electric percussion drill was that invented by Mr. Charles J. Van Depoele, and now owned by the Thomson-Van Depoele Electric Mining Company.

The standard size is known as type D. It is intended to drill a 1 to 2-inch hole in granite at the rate of two to three inches per minute. Nearly a score of these drills are in successful operation, and the results are most gratifying.

A striking illustration of the value of this type of drill is found in an extensive plant of Van Depoele drills now in operation under the charge of the United States government at the Rock Island Arsenal, Rock Island, Ill. Prior to the advent of the electric drill, seven gangs of men were at work, each gang consisting of three men, one to hold the drill and the others to strike. With this arrangement they considered that 20 feet of hole per day of 10 hours was very good work for one drill. The men were paid $1.69 per day wages. The average number of feet drilled per day was found to be between 17 and 18. This made the cost about 30 cents per foot, exclusive of smith's work, etc.

With the electric drills 60 feet of hole per day was an average, bringing the cost of drilling per foot down to less than 12 cents. The plant was put in operation with one drill working during the first 10 days, on the eleventh day two drills were started; and on the twelfth day another was added. From the holes thus drilled in these first twelve days a strip of limestone rock 300 feet long, 4 feet deep and about 10 feet wide was blown off, moving in all 1,200 tons of rock. The plant has been increased, and has the distinction of being the first successful electric drilling plant operated by the United States government.

In drilling by hand it has always been found that the drill hole cannot be given much "lift;" that is the holes must be drilled nearly vertical. With the electric drill they can be driven at an angle of 30 degrees off the vertical, the result being that it is possible to lift the rock with about two-thirds the quantity of dynamite required in firing the hand drilled holes. On an extensive plant this means a large saving.

The blasts are fired by a current from the dynamo which operates the drill, a special fuse arrangement having been devised for the purpose.

Some years ago a government authority made a report as to the character of the stone where the electric drills are now at work. In that he stated that owing to its being very hard limestone, filled with clay, seams and cracks, it was much harder drilling it than granite.

More than a score of these drills are in operation in other places, and reports of their work are most gratifying. Fig. 1, for which we are indebted to the *Engineering Magazine*, shows this drill at work in a Western mine.

The Marvin drill, developed by Mr. H. N. Marvin, of Syracuse, in 1886, and now controlled by the Edison General Company, has no doubt a wider application than any other electric drill on the market. More than 50 of these drills are now in daily operation, and are meeting with success. They have been subjected to all manner of tests, and have worked under all conditions.

One of the first tests of this drill was made at West Quincy, Mass., in the well known Quincy granite. Here the drill bored a hole 1¼ inches in diameter at the average rate of 2¾ inches per minute, with an expenditure of 3 h. p. delivered to the generator. At one time the rate of drilling was as high as four inches per minute. Though worked continuously for more than an hour, very little heat was developed.

The wires were taken from the edge of the quarry direct to the place where the drill was at work, no further intermediate supports being needed. The distance along the wires was 350 feet, while the vertical distance between the drill and the edge of the quarry was 100 feet.

For the purpose of exhibiting the ease with which the machine can be taken to pieces and the defective parts replaced by others held in reserve, the drill was several

times opened and entirely taken apart, the time required being less than 30 minutes.

The plant now being operated by the Great Northern Railway shows still more remarkable results. Here four Marvin drills are at work on the almost perpendicular cliffs which skirt the river. The power plant, consisting of boiler, engine and dynamo, is arranged on a barge, the barge being moved along as the work progresses. From this floating plant the wires run to the drills that are digging away into the mountain, giving a good illustration of the flexibility of the system. The drills bore to a depth of 18 feet with comparative ease. Only three-quarters of a cord of wood per day is required for fuel, and the plant has greatly pleased its owners.

The exhibit in connection with the recent Montreal Convention of the National Electric Light Association would be memorable for the display of mining machinery made there if for nothing else. A full sized Thomson-Houston percussion drill was in actual service during the entire exhibition, receiving its current from the McGill University three-quarters of a mile distant. In this same exhibit were also shown a mining hoist and pump.

In the Edison exhibit the three types of drills manufactured by this company were shown to advantage; namely, the percussion drill, diamond prospecting core drill, and the rotary coal drill.

The experiment made by the Edison company some time previous for the benefit of the mining engineers who had met there was not a complete success, owing to several reasons that it was difficult at the time to understand. It seems that owing to delays of the Custom House the machines were not delivered until one day previous to the test. This left but very little time to erect a steam plant, arrange the rock to be drilled, and make the necessary connections. When the drill was put in place it was found that several important parts were missing, and crude ones had to be made in a very short while. Finally, when the drill commenced work the rock was found to be so brittle that it was completely shattered by the first few blows, making it impossible to drill to any depth. One thing,

Fig. 2.—Latest Design of Thomson-Van Depoele Percussion Drill.

however, this test did demonstrate, and that was the great force of the blow which the electric drill was capable of striking

PROSPECTING DRILLS.

After mineral indications have been discovered the first step is to determine the value of the deposit by its nature and quantity, its exact location, by which is meant its depth and the direction in which the veins run, and, lastly, the area of the deposit. The present method of accomplishing this is by means of a diamond core drill which brings out a core of sufficient size for all tests and assays. This core gives the exact character of the metal at the place the hole is drilled, and by making a number of them the exact value of the deposit is determined, as well as indicating the probable cost of mining the same. It also enables the selection of the best place from which the mineral can be reached by tunnel, shaft or slope.

One of the first electric drills constructed for this purpose was that invented by Mr. I. E. Story, of Boulder, a cut of which is given herewith.

The drill consists of a four-pole motor with specially wound armature, all incased in a wrought iron shield. The feed is accomplished by a set of screw jaws, and is fed to its full length, when the jaws open and the drill rod moves back.

The pump is mounted on the upper end of the drill rod, being operated directly by the rod. The pressure is automatic, being regulated by the pressure of the drill.

The regular diamond bits are employed, and have been adapted to this drill for bringing out ¾ inch, 1⅛ inch and 1½ inch cores. A recent test of this ingenious drill gives the following figures:

Rate of drilling per minute	1.95 in.
Average distance of hole drilled	18 ft, 2 in.
" horse power	1.69
" ampères	5.25
" volts	222

The great advantage of the electric drill is that it can be operated from any light circuit, and the current for it can be supplied to it at two miles distance from the source of power by a wire of one-eighth inch diameter. Using wire of the proper dimensions the drill can be operated five or ten miles with the same ease.

Starting from a convenient and economical source of power, we can, if desirable, lay our wires along the surface of the ground, and in a very few hours be operating our drill miles off. We can then reel up our wire, lay it again in an exactly opposite direction, and again be in operation perhaps five miles off in the course of a few hours more.

Aside from the advantage of this device for prospecting work, it is equally important and valuable for underground service. While it is not likely that a diamond drill can ever be made to do the work of a percussion drill entirely, it is extremely desirable to be able to drill a hole, say, 20 feet or more, into the face of the gangway, and bring out a core which will then show whether it would pay to continue driving on in the same direction, so that it pays the miner to have a drill capable of doing this work in his mine, and

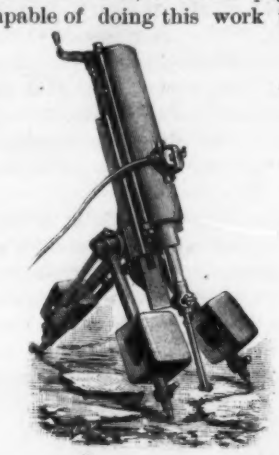


Fig. 3.—Edison Percussion Drill.

when not used for prospecting work, the drill can be profitably used to occasionally drill holes for blasting purposes.

This applies more especially to coal mines where the material in which the mining is carried on is of a comparatively soft nature. Unfortunately, faults in coal mines are very frequent, and the material of which these faults generally consist is too hard to allow the use of the ordinary coal drill. Here the diamond drill is of great assistance, as by its help the vein cannot only be located beyond the fault but it will also help to drive the gangway through the fault, or for any cross-cut work in material too hard for the ordinary coal drill.

That the advantage gained in the use of a diamond drill capable of doing this work has been recognized can be seen from the various attempts made to supply the demand by hand drills.

In using diamond drills, the following advantages found in the electric drill should be carefully considered; the speed is uniform and automatically controlled, so that removing the load quickly will not permit the drill to run away.

The drill can be run at as high a rate of speed as is consistent with smooth drilling, and it is as light and compact as obtainable with the requisite strength.

One of the principal objections to steam diamond drills is the vibrations caused by the reciprocating motion of the steam engine. The electric motor having a rotary motion from the beginning, these vibrations are to a large extent avoided, and it is possible to go to much greater depth than with the steam drill. The item of depreciation of the steam drills owing to the violent vibrations and the necessary gearing is greatly reduced in the electric drill, as is also the space required for the apparatus.

The Edison General Electric Company is now making three sizes of drills, having capacities of 50, 250 and 600 feet

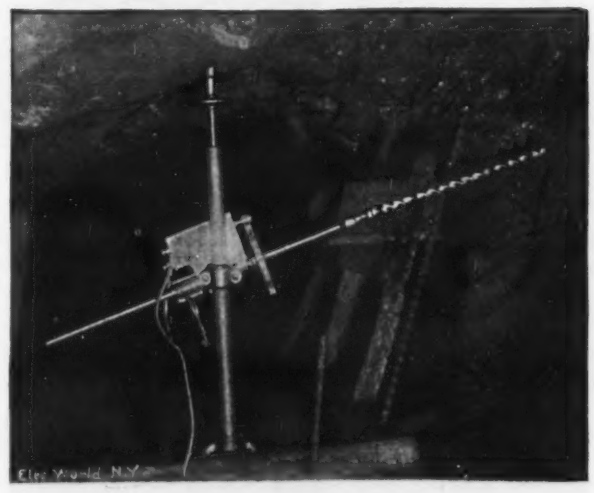


Fig. 4.—First Electric Drill Used in America.

respectively. The Thomson-Van Depoele Electric Mining Company has adopted the Sullivan diamond drill in connection with its motor, and has quite a number of these machines now in operation in the Aspen, Colo., region, and in other places.

THE ROTARY DRILL.

It is in coal mining that this drill is of the greatest importance. In some sections the coal is very hard and has to be blasted out of a solid; that is, several holes are drilled into it, after which it is blasted down with powder without being undermined. The usual amount of coal mined in this way by one man is from three and one-half to four tons per day. It takes about thirty minutes to drill one hole by hand, and about eight holes would be considered a good day's work for one man doing nothing else.

With the electric drill one man can drill a six foot hole in five minutes, or about twenty-five to thirty holes per day, giving an output of fifty tons.

An interesting illustration of this feature of mining is found at Kingston, Ill. The drill consists simply of an ordinary hand drill driven by means of a flexible shaft from a ¼-h. p. electric motor. The latter with its reducing gearing is placed on a small frame that is carried about on a truck. The whole appliance is very crude, but shows the great possibilities of an electrical drill plant of comparatively small cost in districts where the coal is as hard as in the Fourth District of Illinois. A plant of this kind would be well within the means of even a small operator, and enable him to compete with those operating large and expensive coal cutter plants.

Drills of this type have been developed by the Edison company, the Jeffrey company, and the Thomson-Van Depoele Mining Company.

Elements of Practical Electricity.*

BY DR. LOUIS BELL.

RESISTANCE COILS.

For such experiments as you have just been trying it is convenient to have some resistances of wire coiled up in convenient form and ready for use in connection with the batteries and galvanometer. You will do well, therefore, to make a few which will be available for any future work to which you care to put them.

The material you require for these consists of a few good-sized spools such as thread is wound upon, insulated wire, and a little paraffine. Nos. 20, 25 and 30 are the sizes of wire you will find most handy, of the first you will require for the coils you are going to make over 50 feet, of the second about 70 feet, and of the third about 25 feet. Start

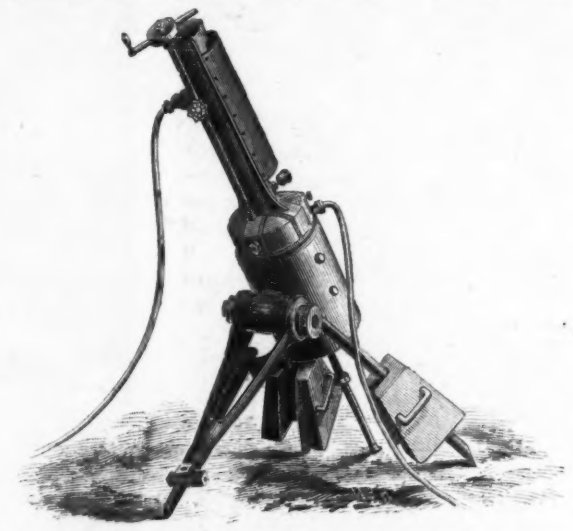


Fig. 5.—The Storey Prospecting Drill.

by taking a very large spool. Close to the flange at one end bore a 16th-inch hole with a brad awl, and in it put a little hard wood peg; a shoe peg answers very well. All the wire should be of the kind known as double cotton wound magnet wire.

Take the No. 20 wire and measure and cut off a length of just 50 feet, double this wire once, and hitching the end around any convenient peg begin twisting it so that the doubled strand, 25 feet long, will be twisted tightly enough to keep it from slipping apart. Then pass the loop at the doubled end of the wire over the peg you have driven into your spool and wind layer after layer until all your wire is used up except about a couple of inches, which, for security, you had better pass through the hole formed by the brad awl in the flange of the spool. Now soak the whole coil in melted paraffine for a few minutes and let it cool. Having done this scrape a quarter of an inch at each end of the wire bare and solder to each a piece of coarse copper wire about two inches long, No. 12 will answer. These ends serve as terminals for connecting your finished resistance coil to battery, galvanometer, or other instruments. Start now with your No. 25 wire and cut off two pieces just 31 feet long, double and twist and wind them in precisely the same manner just described, paraffining as before; then go on with your No. 30 wire. Of your No. 30 wire cut two pieces 19 feet 8 inches in length and treat them just as you have the others. Mark these coils 1, 2, 3, 4 and 5.

Now, repeating the experiments you have previously tried with the battery and galvanometer some rather interesting facts will be disclosed. In the first place, a brief trial will show that the last two coils you have made are, as nearly as you can detect by the galvanometer deflection, equal in resistance, the two previous coils you will also find to be equal to each other, while the first one made will allow a considerably greater deflection than any of the others.

As another experiment, noting carefully the deflection produced with coil No. 1, remove it from the circuit. Put a single terminal of both No. 2 and No. 3 in your galvanometer binding posts, connect the other terminal of both coils to your battery, and supposing it remains constant, as you can readily judge by putting back coil No. 1 afterward, coils 2 and 3 connected so that the current is

*Continued from The Electrical World of Dec. 5, 1891.

free to flow through both of them together will allow just the same amount to pass as did No. 1.

CURRENT RESISTANCES IN PARALLEL.

Resistances so connected are said to be in parallel with each other, from their position, and the current divides itself, provided that the coils are alike as in this case, equally between them. Now taking either No. 2 or No. 3, note the deflection produced when the current is flowing through it alone, remove it from the circuit and in its stead put Nos. 4 and 5 in parallel; again the deflections will be equal, showing that Nos. 4 and 5 combined have the same resistance as either No. 2 or No. 3.

From these experiments we can deduce several things about the relation of resistance to current. Since coils 2 or 3 permitted the same current to pass as Nos. 4 and 5 together in parallel, the resistance offered by the latter pair together is just equal to that of either No. 2 or No. 3. You have seen that Nos. 4 and 5 are equal to each other also, and since we have already found in a general way that small wire lets less current flow than a large one, we are forced to the conclusion that either 4 or 5 has double the resistance of either 2 or 3, for Nos. 4 and 5 in parallel, each taking half the current, only let the same total amount through that would be permitted to pass by either No. 2 or No. 3 alone. We can test the validity of this conclusion by a very simple experiment. Connect a terminal of No. 2 and a terminal of No. 3 together and put the loose ends into battery or galvanometer binding posts, thus putting these two resistances, which we have already found to be equal, so that the current is obliged to flow through both of them in succession.

RESISTANCES IN SERIES.

Resistances so connected are said to be in series with each other. Note the deflection of the galvanometer needle, and then removing the pair, put in either No. 4 or 5. The deflection will remain virtually the same, showing we were quite right in saying that Nos. 4 and 5 were of double the resistance of Nos. 2 and 3. From all this we can draw a valuable practical conclusion; that is, when two equal resistances are placed in parallel with each other the total resistance of the combination is just half of either coil taken separately. It is as if a new channel were opened for the flow of electricity when one wire is put in parallel with another, so that the amount which would flow through one wire is doubled, just as it would be if that wire were cut off to half its length and so presented only half the resistance. That this would be the case you can see from your experiment of putting the two coils 2 and 3 in series.

In these experiments you will notice that every one has been so arranged as to show what is necessary by keeping the galvanometer deflection constant instead of by changing it a known amount. The reason for this is that both the battery and the galvanometer have resistance of amount unknown to you, and consequently you cannot allow for it in comparing any other resistance. If, however, your experiments are so arranged as in each case to bring back the deflection to the same point, you can neglect the effect of all the other resistances that may be in the circuit, provided they remain constant, for you deal in each experiment with the same arrangement of parts, and simply interchange the resistance you are working with so as to produce the same result in each case. A little later we will see how to use the galvanometer in a more general way, measuring currents and allowing for any unknown resistances that chance to be in circuit. You can easily see without any special explanation that if you can find out just what effect in cutting down current a given resistance has, you can then determine other resistances by comparison with that effect, even if these be in the galvanometer or the battery. In order that the resistances, aside from the coils you are working with, may be constant, you must be careful to use the same connecting wires in each case, and not to shake or disturb the battery in any way. A little movement of the porous cup might disturb your battery resistance enough to upset your experiments.

Without knowing in any determinate units the value of the resistance coils you have constructed it has been possible to get a fairly good idea of the relations existing between them and of the effect of putting them in parallel and series; you can see in general that when resistances are in series their effects are added, and you can test the correctness of this by adding one coil after another in series with your galvanometer, and sending the current through the combination from the same battery used before; each successive added coil will increase the resistance, and therefore decrease the current. How is it, however, when several coils are in multiple? Take coils Nos. 4 and 5 and also No. 2, and put all three in parallel between your battery and the galvanometer; a moment's reflection will show you that 4 and 5 in parallel are equivalent in resistance to No. 3 and that therefore when No. 2 is placed in parallel with them the result is the same as if No. 2 and No. 3 had been placed in parallel originally. But this you have already seen gives a resistance equivalent to that of coil 1. Trying the experiment will show you that this equality really exists. So long as the resistances in parallel are equal or equivalent to each other you can take account of them very simply. When they are not equivalent it does not appear at first sight so easy. A little later, after we have learned something of electrical units, how current, resistance, etc., are measured, it will be somewhat easier to understand how to compute the resistance of a number of unequal resistances in parallel. Meanwhile you have learned enough to enable you to appreciate some interesting facts met with in electric lighting. Incandescent lamps are nearly always operated in parallel; for example, all the lights in a large building are in parallel with each other, just as the resistance coils were joined up in your experiments; they are of equal resistance, and precisely as two coils in parallel have the resistance of one coil, so 20 lamps in parallel have a total resistance only a twentieth that of a single lamp. So you see an incandescent lamp circuit must have a rather low resistance. On the other hand arc lamps are almost invariably put in series with each other, consequently the arc circuit must have an enormously high resistance if many lamps are in circuit. As a matter of fact each ordinary incandescent lamp has a resistance at least equal to that of six arc lamps, so that if you compare one circuit with 20 incandescents in parallel and another with 20 arcs in series the arc circuit would have more than 60 times the total resistance of the other. But the same current that flows through one arc lamp flows through each of the rest, while each of the 20 incandescents has to be furnished with enough current to heat it to brilliant whiteness, so that while the incandescent circuit evidently requires a large amount of current, this has to be forced through a resistance so low as to be overcome without great difficulty, while with the arc circuit the current is not nearly so large but must be forced over very many times more resistance. All this, however, you can better appreciate after we have looked into the question of electrical units to find out in what terms we shall measure both resistances and current and that something in the battery which enables us to force current through the circuit in spite of the resistance.

Some Remarks on Safety Devices.*

BY FOREE BAIN.

More than a year ago I suggested to Mr. Haskins the subject of his paper and asked that he present his ideas and experience to the club. I was induced to do this after having made several experiments with so-called fuse wire. I selected samples from as many different makes and found from a few crude experiments that I then made that a fuse wire composed of alloys was simply a guess and often a very poor guess at that. At the time I found that the various samples would not fuse with the current for which they were designed, in fact I found from actual experiment that I could increase the carrying capacity of any alloy or pure metal wire to a burden very far beyond its expected, and to me, known capacity. I will relate an experiment to illustrate. I first selected a fuse marked 10 ampères, I put a good and correct ampère meter in circuit with it and found the fuse did not let go until the instrument indicated 29 ampères; I took another sample of the same wire and increased the current until 42 ampères were indicated passing through it; I repeated these experiments and found, to my surprise, that I could approximately control the carrying capacity of my fuse by the manner and suddenness of introducing the current it was called upon to carry. I then put in a fuse and suddenly threw current on so that it could not rise above 10 ampères, and it would "let go" every time. I think this illustrates that the sudden introduction of the load tends to heat the wire to a very much greater extent than when the current comes on gradually, or it may be explained in this way: It is known that a remarkable molecular change sometimes takes place in metals without their undergoing any alteration from a solid to a liquid state, brass, silver, lead and several other metals when first cast or rolled possess a great degree of toughness without any apparent crystalline structure. If these metals are subjected to sudden and repeated strains they become weak and lose their toughness, a condition frequently known as the fatigue of metal. A similar effect is produced by repeated heatings and coolings, and from this they often become so brittle as to snap apart upon the application of a very slight degree of force. The surface of the fracture then exhibits a distinctly crystalline appearance. This effect does not seem to alter the conductivity of the metal or to decrease its normal carrying capacity, nor does it seem to alter the melting point of the metal. It occurred to me that this effect was more reliable than to depend solely upon the melting point, as I believe that the crystallizing effect always precedes the melting point when electricity fuses a wire. I therefore arranged, and I now suggest the adoption, of a fuse in such a way that it is constantly under strain, by a spring, gravity or otherwise, in such a manner that it will be pulled asunder when its molecular structure is weakened by the overburden of current. A sudden blow will frequently crystallize and destroy the toughness or strength of a piece of metal, when an equal force applied in steady pull or strain will not affect its molecular structure. Again, when a current is applied gradually to a fuse, it has time in which to radiate or conduct away the resulting heat, its structural molecules are not so violently effected and its own resistance for these reasons is not so great.

The spring or weight, which I suggested, acts in a way to agitate and to stretch the metal when the fuse's temperature rises very much above surrounding atmosphere. This stretching reduces the cross section and increases the length of the fuse, both of which add to its resistance so that it will readily and quickly succumb to the effects of an overload, although the overload may come on gradually.

Before leaving this portion of the subject, let me call your attention to an old and well known experiment which has some bearing on this case; water, for an example, in a still atmosphere and in a quiescent state may be gradually cooled to eight or ten degrees below freezing point and yet remain liquid, but the slightest vibration or any extraneous pressure or agitation causes sudden crystallization of a portion of the liquid into ice, which is rapidly communicated to the entire mass. If the water be placed under pressure or strain, as I suggested for my fuse, so that a slight movement or agitation be made to occur at the critical point when crystallization is about to take place, it will hasten this action and cause the process to be more positively effected. In the case of the fuse, the metal will rapidly lose strength the moment crystallization begins; the resilience of the spring will force it apart and thus open the circuit. I believe that pure metal is better adapted to the use than alloy, for the reason that a very slight change in the proportion of the metals in alloys will make a very great difference in its action when used as a fuse. A pure metal is more uniform in its action. I like a pure tin wire for this reason. Another reason is that the coefficient of resistance due to heat is greater in pure wire than alloy. I like tin because its melting point is lower than any other pure cheap metal, except lead; it does not oxidize so readily as many others and it does not crush like lead; it is not so good a conductor of heat or electricity as copper.

Referring to Mr. Haskins' paper, where he speaks of fuses for telegraph and telephone circuits, I will describe a safety device which I made 10 or 12 years ago to protect gas lighting circuits, or in other words, it opened the circuits to prevent polarization of the batteries. It consisted of a small hard rubber rod about three inches long and one-eighth of an inch diameter; around this I wound 10 or more turns of No. 30 German silver wire over its entire length, which was included in the main circuit. One end of this rod and the wire were rigidly attached to a brass disc, to which the remaining end of the German silver wire was attached. This disc was made to bear upon a metal terminal so that the circuit would be complete through the disc, German silver wire and the pillar. A certain amount of strain of the rod was necessary to make contact between the disc and the terminal. Against this strain was arranged a spring. The operation of the device was as follows: A current greater than that designed for the apparatus would heat the wire, the heat would soften the rubber, and the differential spring would push it and the disc off of contact with the terminal, and thus break the circuit. When the rubber rod became cold again it would regain its elasticity and be once more ready for action. To set the device it was only necessary to turn it one-half revolution, when the disc, being eccentric in position, would make contact again with the terminal and close the circuit. This is admirably adapted for circuits of small currents, such as telegraph, telephone bells, gas lighting, etc., and a modification of it might be used very satisfactorily for much heavier circuits.

I have seen protecting devices in which a resistance wire was used to melt a chunk of tallow which held contacts together. Electromagnetic devices are sometimes successfully used and are in great measure very reliable. An objection I may offer first: moving portions, which offer more or less mechanical resistance by stiff, rusted or corroded joints or pivots; another objection, when used for heavy currents is based upon the feature of contacts, which must be pressure contacts and not frictional contacts. These become corroded, easily heat, and interpose useless resistance; the act of breaking the circuit produces an arc, this intensifies the oxygen in the surrounding atmosphere or produces ozone which quickly coats the contacts with a high resistance film, so that they go together again; if they are not cleaned they are liable to heat. We all know from experience that the inanimate persistence of matter in all devices is eternally tending to go wrong; we must not, therefore, increase the duties of the so called attendant by introducing anything that would ruffle the easy tenor of his everyday life.

* Discussion of C. C. Haskins' paper before the Chicago Electric Club, Dec. 7. For Mr. Haskins' paper see page 428.

A New Method of Electroplating with Aluminium.

The essential features of a new system of electroplating with aluminium, says the London *Electrical Review*, are as follows:

A solution of ammonia alum in warm water is prepared, containing 20 per cent. of alum. To this is added a solution containing about the same quantity of pearlash and a little ammonium carbonate. The mixture results in effervescence and in the deposition of a precipitate. The latter is filtered off and well washed with water.

A second solution of ammonia alum, containing 16 per cent. of alum and eight per cent. of pure potassium cyanide, is now prepared warm and poured over the precipitate previously obtained, the mixture being then boiled for 30 minutes in a closed iron vessel, jacketed to insure uniformity of heating.

At this stage about 20 kilogrammes of water are added, and about two kilogrammes more of potassium cyanide, and the whole is kept on the boil for about a quarter of an hour.

The liquid is then filtered from the precipitate, and is now ready for use in the electrolytic bath.

The anodes are perforated or slotted plates of aluminium, arranged so that they can be conveniently raised or lowered. The cathodes receive the deposit.

The proportions suitable in the above solutions are as follows:

First alum solution :	
Ammonia alum	2 kilogrammes.
Warm water	10 "
Pearlash solution :	
Pearlash	2 kilogrammes.
Warm water	10 "
Ammonium carbonate	8—10 grammes.
Second alum solution :	
Ammonia alum	4 kilogrammes.
Warm water	25 "
Potassium cyanide	2 "

The anodes and the cathodes are connected respectively to the terminals of a battery or of a dynamo machine, and the current is thus transmitted through the bath, which is kept throughout the operation at a temperature of about 80 degrees to 150 degrees Fahrenheit.

By attaching to the aluminium anode pieces of other metals, *e. g.*, gold, silver, nickel, copper, etc., the tint of the deposited metal can be somewhat varied. When the deposit presents a gray tint it is brightened by dipping the plated article in a solution of caustic soda, which has also the effect of impeding oxidation.

Government Telegraphs.*

BY E. ROSEWATER.

The founders of our republic conferred upon Congress the power to establish post offices and post roads. It is scarcely conceivable that it was their intention to limit the national legislature to the conveyance of the mails in post coaches running over wagon roads. The manifest scope of the constitution touching the exercise of the power to establish and maintain a postal system is to facilitate commercial and social intercourse between the people by the use of every device that will insure the speedy and economic transmission of intelligence. The century that has elapsed since Benjamin Franklin assumed charge of the first post office in the United States has witnessed the transition from the postal stage coach, the pony express and carrier pigeon, to the "fast mail" train drawn across the continent at the rate of a mile a minute; from the "60 days across the Atlantic" packet sail-boat to the "six days from New York to Southampton or Liverpool" twin-screw steamer. But our postal system cannot attain its full measure of usefulness and efficiency until the electric telegraph and long distance telephones have been made an integral part of our postal facilities, with the pneumatic tube post as an auxiliary for conveying letters and messages in our great population centres.

Everybody familiar with the history of the telegraph knows that Prof. Morse offered his invention to the government for the paltry sum of $100,000, and urged the Postmaster-General to construct and operate telegraph lines as an adjunct of the mail service. It is also historic that the monumental mossback who occupied the position peremptorily declined the offer of Prof. Morse, on the ground that in his judgment such a thing as transmitting messages from one point to another over a wire was preposterous and impossible. In due time, Prof. Morse prevailed upon Congress to appropriate $30,000 for the construction of an experimental line of telegraph, and with this money the first wire built and operated in America was erected between Baltimore and Washington. So the telegraph at its very inception owed its successful introduction in America to the munificence of the government, and by right it should have been operated as a part of our postal system from the outset.

In 1862 Congress was again invoked to aid in the extension of our telegraph facilities. At that time the most rapid communication between the people east of the Mississippi and those on the Pacific coast was by the overland stage and pony express. A bonus of $400,000, payable in ten annual installments, was voted to the company organized to build the Pacific telegraph line. This extension of the telegraph across the continent, from the Missouri River to Sacramento, involved the construction of about 1,700 miles of pole line. The bonus of $235 per mile not only paid for the whole line but left a very considerable margin. The promoters of the enterprise, within five years, realized three dollars for every 15 cents they had actually invested. I have recalled these historic facts merely to disabuse the minds of many who labor under the delusion that our telegraph system, unlike that of other countries, has been built up entirely by private capital and individual enterprise. It is not my purpose at this time to indulge in an exhaustive history of our complex system of telegraphs under corporate ownership. Suffice it to say, it is the natural outgrowth of promiscuous construction, wasteful competition, and reckless absorption. A bird's-eye view of our telegraphs would present a dense jungle of poles planted and transplanted, and a bewildering network of wires strung and restrung by a succession of stock jobbing speculators. As an inevitable consequence, the Western Union Telegraph Company, which has swallowed more than sixty big and small competitors, is periodically overstocked with needless wires between great commercial centres which usually offer the most tempting field for enterprising men who build lines to sell out, while there always has been a lamentable lack of telegraph facilities at small cities and towns that are made dependent entirely upon the congested railroad wires. Our telegraph companies never maintain an office where the receipts do not offset the expenses. Such a policy is not pursued in countries that possess postal telegraph facilities, because the government is at no additional expense for rent, and postmasters in small towns and cities are required to perform the duties of telegraph operators.

Nothing has impressed upon me more forcibly the dangerous tendencies of telegraph inflation and over-capitalization than the comparative exhibit of the world's telegraph system submitted to Congress last winter by the president of the Western Union Telegraph Company. According to Dr. Norvin Green, this country has 185,000 miles of telegraph pole line, as against 375,000 miles possessed by all other countries of the world. There are 673,000 miles of wire in the United States, as against 1,111,968 in all other countries, and there are in America 18,000 telegraph stations, against 53,000 in all other countries. Mr. Green computes the aggregate number of telegrams handled in this country at a fraction over 60,000,000, while he credits the rest of the world with handling 170,000,000 telegrams. As a matter of fact, the aggregate number of telegrams handled in European countries alone, computed officially for the year 1889, is 204,935,055. What do these figures show? With one half of the world's telegraph line mileage, American telegraph companies should have handled one-half the business. Instead of handling 102,000,000 telegrams, they only handled 60,000,000. With one-half of the world's telegraph lines in a country that boasts two-thirds of the railway mileage of the world, America should have her full quota of the world's telegraph stations; but out of 53,000 we have only 18,000, including railroad offices, which comprise nearly three-fourths of our telegraph stations. On the other hand, Great Britain, with less than one third of the wire mileage of the United States, handled 63,403,399 telegrams in 1889. Do not these figures demonstrate that the periodic acquisition of lines built for speculation prevents the economic working of our system by clogging it with useless wires, and will always operate as a barrier to a material reduction of our telegraph tolls, because our telegraph companies adjust these tolls on the basis of a capitalization which at this time already includes from $40,000,000 to $50,000,000 of stocks and bonds issued for speculative plants?

Let us take a cursory survey of the government telegraphs abroad. I trust that I violate no confidence in stating that before embarking for Europe last summer I procured letters of introduction from Postmaster-General Wanamaker to the postmasters of England, France, Germany and Austria, coupled with a request that their respective departments extend to me facilities for making an inquiry into the practical operation of their systems of telegraph. This investigation was a self-imposed task. I have for more than a quarter of a century been an outspoken advocate of the postal telegraph, and desired to see for myself how it worked in foreign countries. Upon presentation of my credentials, I was everywhere accorded the most courteous reception. The chiefs of the telegraph bureaus, telegraph engineers and superintendents, took pains to exhibit the operating rooms, instruments, batteries and appliances to me, explained to me the methods pursued in handling dispatches, and freely answered all inquiries concerning construction of lines, subways, office regulations, number and qualifications of employés, working hours and wages. They also furnished me sample telegram blanks and official documents relating to the management, extent of plant and business done. The Hon. J. Cameron Lamb, general manager of postal telegraphs for Great Britain, favored me with an official letter to the postmasters of Manchester, Birmingham and Swansea, which enabled me to inspect the telegraph operating rooms and investigate the operation of postal telegraphs in those so-called provincial cities.

I will read you Mr. Lamb's letter, which I was permitted to retain as a souvenir of British official courtesy :

To R. M. Johnson, Esq., Postmaster and Surveyor, Manchester; J. F. Wight, Esq., Postmaster and Surveyor, Birmingham; E. H. Oakden, Postmaster, Swansea.

DEAR SIRS: The bearer of this note is Mr. Edward Rosewater, Omaha, United States. The Postmaster-General desires that he may have full information regarding the telegraph work in your offices, and I am to ask that you will be good enough to allow him to see the operations actually performed and to afford him all necessary facilities. I am, dear sirs, yours very truly,

J. C. LAMB.

Similar courtesies were extended to me by the Director-General of the German postal telegraphs, Dr. Haake, and Dr. Newbauer, Director-General of the postal telegraphs of Austria.

The first step toward merging the telegraph system of Great Britain with the postal service was taken in 1868, when Parliament passed an act authorizing the purchase or leasing of all lines operated by private companies.

The proposition to establish a postal telegraph had been vigorously opposed by the telegraph companies at every step, and when the transfer was finally made the government came into possession of a conglomerate system of lines which had been allowed to run down by the companies from the time Parliament had voted to take them out of their hands. The act of 1868 fixed the uniform rate of one shilling (25 cents) for a message of 20 words, exclusive of address and signature, and three pence (six cents) for each additional five words, to all parts of the United Kingdom. This was a material decrease from then existing rates, and, as a natural consequence the postal telegraph lines, in their wretched condition, were for a time inadequate to handle the increased business. This defect was, however, remedied as soon as the tumble-down lines had been reconstructed and the old plant had been thoroughly overhauled.

In 1870–71 the number of messages handled by the British postal telegraph was 9,850,177. In 1874–75 the number had increased to 19,253,120. In other words, the number of telegrams handled had doubled within five years. In 1880–81 the number of telegrams handled was 29,411,982, another increase of 55 per cent. in five years; and in 1885 the number of messages handled had reached 39,146,283. By the Act of October, 1885, the rate on telegrams to all parts of Great Britain was reduced to six pence (12½ cents) for a message of 12 words, including address and signature, and one halfpenny (one cent) for each additional word. This reduction was followed by an enormous increase of business. In the year 1886–87 the number of telegrams handled was 50,243,639, and in the year 1890–91, 62,403,399.

This vast volume of telegrams is handled by the British postal telegraph with promptness and marvelous accuracy, so far as I was able to observe. In London the city messages are transmitted exclusively by postal pneumatic tube. The pneumatic tube department in the great central telegraph station handles the bulk of the letters, dispatches and cards that are delivered within the city of London. Outside of the London Exchange, which is supplied with an independent system of direct commercial wires, all communications within the city of London proper are dispatched by pneumatic tube.

Thousands of dispatches, letters and postal cards are literally shot by air pressure every hour of the day from the 20 postal tube stations located at the points most accessible into the Central telegraph station, and there they are redistributed and fired back to other stations, delivered by carrier or forwarded by telegraph or telephone to points outside of London. The longest of those tubes is that from the Westminster Parliament building, through which the proceedings of Parliament are shot to the Central telegraph office, and thence transmitted by wire to provincial cities or delivered to such London papers as may order duplicates.

The tubes have not only enabled the postal authorities to transmit the dispatches and city letters in London more rapidly than they could be forwarded by wire, but they have done away with the costly and inefficient local wire service and in a measure the pole and wire nuisance. But to the public, the greatest benefit of the tube system is its cheapness. In New York or Chicago a city measage of ten words or less costs you 20 cents. In London you can send as many words as you can write on the blank or card, which varies from 100 to 1,000 words, for six pence (12½ cents), and, what is also important, your message will have been delivered almost before the girl that usually acts as operator in the hotels of local offices in our cities has had time to copy it. By the tube system no copying is done—the original message is delivered to the party to whom it is directed, unless it is to go by telegraph or telephone to points beyond London.

While London was the first city to utilize pneumatic tubes for the rapid transmission of mail matter and telegrams, the cities of Paris, Vienna and Berlin have for years been served by pneumatic tube post. During the year 1889 the pneumatic tube post of Vienna handled 2,692,752 letters, telegrams and postal cards. Of this number, 1,541,647 were telegrams. But the city of Berlin can truthfully boast the most perfect and best served system of postal pneumatic tubes in the world. While London has only 20 pneumatic tube stations, Berlin now has 51 distributed not merely over the entire area of the German capital, but reaching out into the suburbs. You may deposit your message in one of the pneumatic tube stations, and it will reach any point within the radius of 10 miles within six minutes, including a re-transfer at the central tube station. For six cents and a half your message or letter inclosed in one of the specified post envelopes, will be fired through the tubes from Berlin to Charlottenberg, and delivered by postal carrier.

Berlin has about the same population as New York, but New York does four or five times as much business by mail or telegraph. But it takes from one hour to half a day to transmit and deliver a message by mail or wire from the City Hall to Harlem.

The Postmaster-General of Great Britain was empowered by the Act of 1868, which authorized the acquisition of the telegraph lines, to facilitate the collection and transmission of dispatches by designating places for depositing telegrams in letter-boxes and other depositories, and telegrams deposited therein are, if written on stamped paper of proper value, conveyed by letter carriers to offices of transmission by wire or to the tube stations free of charge. This is a convenience that we cannot secure so long as our telegraph lines remain under corporate ownership. But the postal telegraph facilities in London, even without this special convenience, could scarcely be improved on. At the present time there are 538 stations in London from which telegrams may be forwarded. Of this number, 451 are branch post offices and 87 are railway station offices. Inasmuch as the telegraph tolls are uniform throughout Great Britain, parties simply purchase stamps covering the cost of any message and the stamped blank is rushed through the tube to the Central Station, and thence transmitted by wire to its destination. A telegram with the proper stamp attached, dropped

* An address before the New York Electric Club, Nov. 30, 1891.

into a post-office box in any city in Great Britain, will be wired from the nearest telegraph station just the same as if the sender had gone through the tedious formality of handing it directly to the receiving clerk at the telegraph office. For the accommodation of business men and other patrons who use the telegraph frequently, stamped telegraph blanks are supplied at a trifling extra charge for paper. Similar conveniences are enjoyed by the people of France, Germany, Austria and other countries of Europe.

It would be impossible within the scope of this lecture to describe in detail the great operating rooms of the capitals of Europe.

The largest telegraph office in the world is in the British metropolis, employing an aggregate of over 3,300 operators and clerks in one building. Of this number two-thirds are men. The female operators occupy a large and well lighted hall in which the Morse instruments, with registers and paper reels, are used exclusively. Nobody is permitted to receive by sound; and this is also the strict regulation on all telegraph lines where Morse instruments are used in France, Austria and Germany. The main operating room in London is like a great machine shop, although not half as noisy as the main office of the Western Union in this city. All the most improved telegraph appliances are utilized. The English Wheatstone with modern improvements appears to have the preference. The Hughes printing instruments, perfected in England, are receiving greater appreciation in Europe than they do in America.

In Berlin the Hughes printing instrument has the preference and one hundred of these are used in the Central telegraph station. Delany's sextuplex, an American invention, has been in active use in London for several years and the inventor and patentee received £20,000 and $10,000 royalty per year from the British government. This fact affords sufficient proof that the government telegraphs in Europe utilize all the inventions as rapidly as do the American private companies. The operating room of the Central Paris telegraph office is a rectangular hall with Gothic arch ceiling. The operating tables are placed to insure convenience for retransmissions. The Morse instruments are in use on short circuits, and the Hughes printing machine operates on several lines, but the favorite instrument on the French telegraph is the Baudet. This is a printing telegraph operated by synchronous movement. The only skill required is in transmitting. The receiving is automatic, by a paper roll three-fourths of an inch wide on which a message is printed. These printed slips are pasted on telegraph blanks delivered as they are received. The Baudet instrument has been perfected so as to operate duplex and quadruplex—this is sending and receiving two or four dispatches simultaneously over one wire. The operating force in the main office at Paris consists of 550 men and 450 women. The day operators work seven hours and the night men ten hours. The night men receive larger pay and extraordinary pay after midnight. In France as in England the Postal Telegraph employés are allowed two weeks' vacation each year with full pay. At the central telegraph station in Vienna about 500 instruments are in use, largely composed of Morse registers and Hughes printing machines. The Hughes instrument has been perfected by an ingenious Austrian electrician, and is now operated on several long wires as a quadruplex. The American plug switches supplied with wires separated into divisions most in use in Vienna are exceptional features. At London, Paris and Berlin the switches are altogether on a different model. At the Berlin central telegraph station no duplex or quadruplex instruments are in use, the government having supplied an abundance of wires for the volume of business done.

One of the novelties introduced at Berlin is the use of an accumulator battery. This battery consists of 120 cells divided into three sections of forty each; only two of these sections are in use at any one time they operate. A steady current and no variation has been noted during the 10 months that they have been in use. The German government pays the Berlin Electric Lighting Company 16 marks, or less than four dollars per month, for maintaining this battery, from which 300 wires are steadily supplied with electric current. The managers of the Berlin office pride themselves upon the fact that they have worked direct with Teheran, the Persian capital, a distance of 3,500 miles. A through line from Berlin to Rome over bronze wire works admirably and is now in constant use. The most commodious and magnificent telegraph office in all Europe at the present time may be found at Birmingham. The operating room in Birmingham is a new building recently completed by the government. The room is a quadrangle 206 feet by 42, lighted from all sides and equipped with the most modern appliances and the finest test board switches in all England.

This rambling survey of the great telegraph stations of the European capitals may be somewhat disappointing, but it is impossible within the limit of time at my command to enter into greater details.

The impression has prevailed in this country that the postal telegraph service of Europe does not afford as good facilities and cheap rates to the press as do the telegraph lines of America. This I have found to be erroneous. While the British postal telegraph does not permit preference in the transmission of dispatches to any patron, the press dispatches are transmitted over special wires. The efficiency of handling press dispatches in London surpasses anything I have ever seen. Reporters and correspondents file their dispatches, inclosed in special envelopes, directed to the Intelligence Bureau; they are immediately shot into the Central postal telegraph building and transferred through a pneumatic tube into the Intelligence Bureau; there the envelope is opened, the dispatch checked, and at once transmitted by special wire, or by telephone, as the sender may direct. Press dispatches may be duplicated to any number of papers, and parliamentary proceedings and other general news is often wired simultaneously to from 200 to 300 papers.

The Intelligence Bureau supplies leased wire service to leading dailies, and one may lease a wire for all night or for short periods at very reasonable rates. The London *Times*, Manchester *Guardian*, Liverpool *Courier*, and dailies in Edinburgh, Glasgow and Dublin receive the bulk of their telegrams by a leased wire. Charges for any distance in Great Britain for press messages are as follows:

For every 100 words between 6 P. M. and 9 A. M., 1s. (25 cents).

For every 75 words between 9 A. M. and 6 P. M., 1s. (25 cents).

For press dispatches sent to more than one address, 2d. (4 cents) for every 100 words in the night or 75 words in the day for each additional paper.

Computed for a service of 1,000 words a night, a special dispatch directed to one paper would cost $2.50; the same dispatch transmitted in the day to one paper would cost $3.33. But suppose that this service is to go to a press association of ten papers, then the service would be for 1,000 words, night, $6.50 to the ten papers; in the day to the same papers, $8.13. If the service is to go to 25 papers, then the cost of 1,000 words in the night would be $12.10, and transmitted in the day, $14.85. This is less than 1¼ cents per word night work, and 1½ cents for day work delivered to 25 papers. In other words, each paper in an association of 25 dailies would pay only 48⅜ cents for 1,000 words of night report and 59⅜ cents for 1,000 words of day report, while 10,000 words of night report would cost $4.84 and 10,000 words of day report $5.93 per day for each paper. This is certainly a lower rate than the most favorable contract any telegraph company has ever granted to the Associated Press or any other association.

The rate charged for leased wires in Great Britain is $2,000 per annum for a line extending to any distance within the United Kingdom, the service beginning at 6 P. M. and terminating at 9 A. M. for six nights in the week. The government furnishes the operators and instruments. Leased wire messages are delivered free at newspaper offices at a distance one mile from the main office. Special wires can be extended into newspaper buildings by the payment of additional rental computed on a distance basis which would be very trifling. In this country the wire rental is computed at $10 per mile. A line 200 miles long would rent for $2,000 a year, and the paper leasing the same would have to pay for the operators, which would incur an additional outlay of $2,000 per year. A line between New York and Cleveland, a distance about the same as that between London and Glasgow, would cost $6,000 a year for wire rental and $2,000 for operators, as against $2,500 charged for the same service in Great Britain. The press service receives special care at the Paris central office, and the leased wire service is even more liberally arranged in France than in England. You can lease a wire for an hour and even for five minutes. The rate for one hour over a wire extending any distance within the Republic of France is 30 francs, or $6, including operators' service at both ends, or 2½ francs, or 50 cents, for five minutes. The average transmission is 2,000 words an hour, and often with very rapid presses 300 words in five minutes. International wire service is necessarily dearer. There are, however, several international wires leased by newspapers and the Press Bureau. The New York *Herald* has a leased wire for certain hours between London and Paris, and the Reuter and Havas correspondence bureaus have several wires leased which are operated by them for the transmission of International Press News analogous to the Associated Press reports. The French postal telegraph grants a rebate to the press for the time during which a leased press wire is in use for commercial purposes. When the press has leased wires and the government use them in the interval when they are not in use for press dispatches the expenses are shared in proportion to the service.

In Austria the bulk of all press dispatches is transmitted by long distance telephone, which is part of the postal telegraph plant in that country. This is also true of Germany. All the press dispatches between Vienna and Prague, a distance of nearly 300 miles, are transmitted by telephone at rates computed according to the time consumed.

The salaries of postal telegraph employés in Great Britain will compare favorably with those paid for the same class of operators in this country, barring perhaps a dozen officials of the highest rank. The pay-roll of the British postal telegraph embodies:

LONDON CENTRAL TELEGRAPH STATION.

Male Staff.

1 Controller	$5,000
1 Deputy	3,750
2 Assistants	2,500
19 Chief operators	2,000
52 Assistant chiefs	1,550
48 Second class chiefs	1,500
170 Senior operators	950
441 First-class operators	800
1149 Second-class operators	550

Female Staff.

1 Matron	$1,150
9 Supervising operators	900
18 Assistant supervising operators	700
40 Second-class operators	550
230 First-class operators, per week	9.50
521 Second-class operators, per week	7.50
53 Pneumatic tube attendants, chiefly boys, per week	7.50

	Annual Salary.	Annual Increase.
1 Engineer in-chief	$6,000	$250
1 Assistant and electrician	4,750	125
1 Submarine supt. at Woolwich	3,500	125
1 Superintending engineer	3,500	125
1 Assistant supt. engineer	2,250	125
13 Supt. engineers	3,000	
31 First-class inspectors	1,400	
64 Second-class inspectors	1,050	

This salary list should allay the groundless fears aroused among our former associates in the telegraph service, that a postal telegraph would reduce them to starvation wages. Another feature of the British telegraph management is the retirement of aged employés on an allowance that places them beyond dependence. By the Telegraph Purchase Act of 1868, all telegraph employés who had been in the service of the companies 20 years or more prior to the purchase, and failed to secure re-employment in the postal telegraph service, were to receive annuities equal to two-thirds of their salary, and if less than 20 years, the annuity was to be reduced by one-twentieth for every year under 20; but no annuity was granted to any employé who had served less than five years in the telegraph companies' employ. In 1891 there were on the postal telegraph pay-roll the following ex-employés of the telegraph companies:

7 Chief officers and superintendents,
25 Inspectors and linemen,
37 Clerks and 1 messenger, for in all 70 persons.

There were also the following employés retired on account of old age or disability:

1 Engineer-in-chief	$4,000
1 Controller	2,805
108 Male operators	445
67 other employés, including linemen, messengers and laborers.	

This is certainly liberal treatment. The same policy is pursued in France, Austria and Germany. In the latter country postal telegraph employés share with all other government employés the benefits of the system of life insurance and annuities after a long term of service. But the most striking feature of the government telegraphs in its relations to employés is the impartial promotion of every person according to capacity and merit, and the assurance of employment during good behavior.

The tenure of office, or rather of employment, constitutes one of the most commendable features of government telegraphs, and is the most potential safeguard against political interference with persons employed in this branch of the public service. "The greatest trouble we have," said the Director-General of Telegraphs for Germany, "is to get rid of a man who makes himself offensively disagreeable. We cannot discharge a man who has been placed on the permanent employment roll after two years' probationary service until he has been convicted of a criminal offense before a court under the same process that is prescribed for violators of the criminal code. We can fine him for neglect of duty or suspend him for a short time, but he cannot be dismissed from the service." In this country operators hold their places subject to the whims and caprice of officials often their inferiors in point of ability, and no redress is afforded for the most glaring injustice.

Now a word about the political influences of the postal telegraph. My investigations were confined to four countries, England, France, Austria and Germany. France is a republic like ours, and party feeling is more intense there than in America. England is a constitutional monarchy, governed by party that holds its supremacy through electoral majorities. Germany and Austria are limited monarchies. In all these countries the uniform response to my inquiries concerning political interference with telegraph employés, or abuse of power in tampering with messages, was uniformly the same. The chief operator of the Swansea (Wales) office declared most emphatically that he was a radical and decidedly opposed to the present conservative party in power. He said also that a number of the operators in his office were either radicals or liberals, but "if the postmaster who has supreme control of the telegraph force dared to dictate what ticket we should vote, or undertook to interfere in any way with our rights as citizens, we should soon have a Parliamentary inquiry, and the postmaster would soon find himself dismissed in disgrace." In Paris, Mons. Magne, Director-General of Telegraphs, expressed great surprise at my question about political interference with postal telegraph men. "We all exercise our rights as citizens untrammeled," said he; "postal telegraph men are not allowed to take an active part in campaigns or in public meetings, but all vote as they please." Such a thing as trying to delay a political message, or tamper with it, or divulge its contents, has never been heard of in France. The attempt, if made, would cause a revolt and overthrow the party that was in power at the next election. The Director-General of German Telegraphs was equally emphatic. He said: "There are quite a number of social democrats in the telegraph service. These men are virtually committed against our form of government, but we cannot interfere with them so long as they do not conduct themselves treasonably." In all European countries the laws against delaying or destroying telegraphic dispatches are much more severe than they are in this country.

It gives me great pleasure to be in a position to pay a high compliment to American telegraph operators. After careful inspection of the postal telegraph in the British metrop-

olis, in Paris, Berlin, Vienna, Birmingham, Manchester, Hamburg, Prague and other European cities, I can truthfully assert that the most skillful telegraphers of the world are in America. One of our first class operators does fully as much work in a given time as is done in London, Paris or Berlin by two operators. On the other hand, the European telegraphers as a class have a higher education and are fitted not only to manipulate instruments and transmit dispatches, but to supervise other branches of the postal service. In Germany telegraphers are classified from the outset into two classes; the first class is made up of men who have received a high school education before entering the service. This class receives the lowest pay and can only aspire to promotion within the telegraph service. The second class is made up from graduates of universities, who are paid a higher salary from the outset, and are in line of promotion as electrical engineers, superintendents and finally postmasters in the larger cities. This feature has

FIG. 1.—PASS & SEYMOUR INSULATOR.

made the telegraph the stepping-stone toward important positions in the civil service that are directly or indirectly connected with the postal system.

New Form of Insulators.

The enterprising firm of Pass & Seymour, Syracuse, N. Y., has perfected and placed on the market two forms of insulators, cuts of which are given herewith. Fig. 1 is an insulator designed as a circuit breaker. Its great advantage

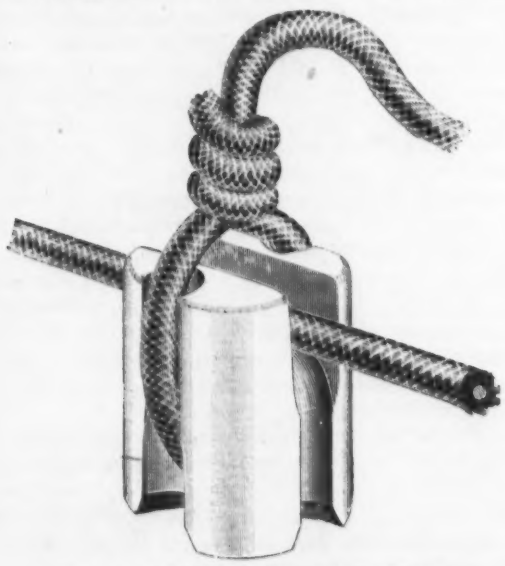


FIG. 2.—PASS & SEYMOUR INSULATOR.

is that the distance between the wires is the greatest possible, and being placed in grooves in the porcelain, they are largely protected from moisture, thus securing a good insulation. For strength it will stand the breaking strain of any wire that can be attached to it. These insulators are made in three sizes.

A porcelain cleat intended to take the place of the wooden cleats commonly used is also made. It is so made that the wire may be held in position loosely until properly adjusted, when, by tightening the screw, the wire is bent in the rounded jaws of the cleat and held very firmly. This insulator holds any size wire, from the smallest used to No. 6.

Both these insulators are made of the well known Syracuse china, fully glazed, manufactured only by Messrs. Pass & Seymour. They have recently doubled their insulator plant capacity and completed arrangements to furnish work with the greatest promptness.

Q. & S. Cord Adjuster.

All construction companies and users of the numerous devices now made for adjusting electric lights suspended by flexible cord will appreciate the little invention just brought out by the McCreary Electrical Specialty Company

FIGS. 1 AND 2.—Q. & S. CORD ADJUSTER.

and shown in the accompanying illustrations. The company has named it the "Q. & S." (quick and sure) cord adjuster. Its advantages are that it can be attached to any cord after the lamps are hung and connected and there is no wear and tear on the cord by taking it up or letting it out. They are made of the best insulated fibre and are very strong and durable. Costing but a trifle more than the devices now used, the difference, it is claimed, is more than made up in the saving of labor. Being very small and neat they are ornamental and do not take up any of the cord when not in use.

Rushmore Low Tension Multiple Series Lamps.

The Rushmore multiple series lamp is so designed as to make each lamp practically independent. It contains only a main magnet and a derived circuit magnet, which act upon a simple and effective device in a manner claimed to be entirely different from any heretofore employed. By means of a purely mechanical device the shunt circuit is automatically opened after the carbons are consumed.

Among the desirable features of this lamp are: Simplicity of construction; interchangeable parts; extremely light framework, constructed of wrought iron and composition; and compactness, the lamp being no longer than is necessary to accommodate the carbons. These lamps will burn singly on 50 volts, two in series on 110 volts, three on 150 volts, and so on.

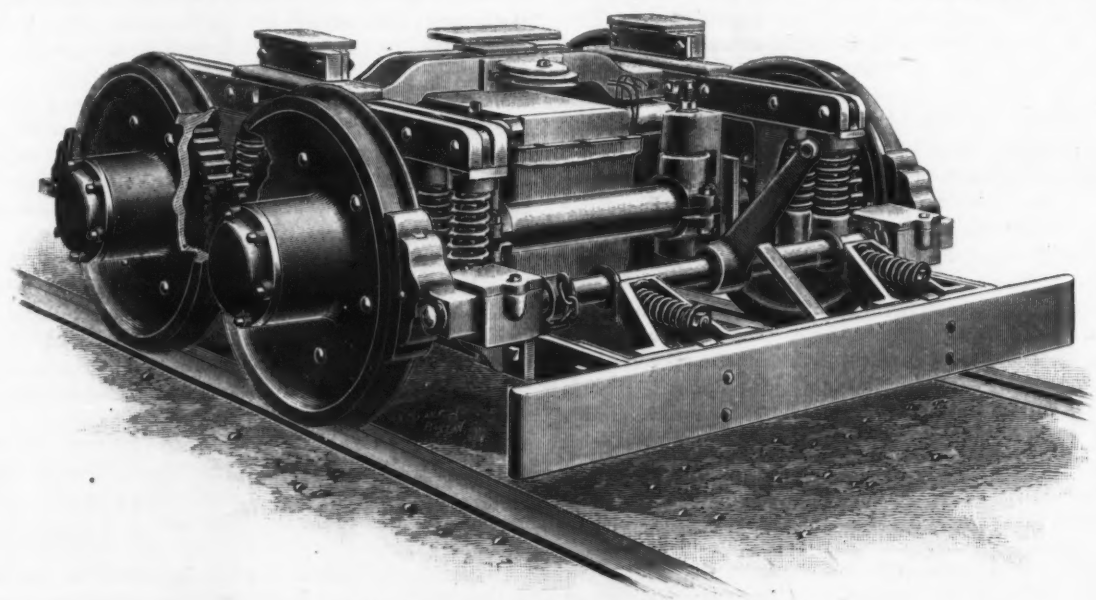
In the case of railway circuits, ten of these lamps may be placed in series on 500 volts on good lines, but as a general thing a smaller number than this is advised. The railway lamp is provided with a resistance equal to that of the lamp when burning, which is automatically thrown in circuit when for any reason the lamp is extinguished. This lamp is placed upon the market by the Scott Electrical Manufacturing Company.

Loose Wheel Electric Truck.

An electric truck, a view of which is shown in the accompanying illustration, embracing some features of novelty, has lately been patented and placed on the market by the Tripp Manufacturing Company, Boston, Mass.

The wheels, 26 inches in diameter, are loose upon the axle, and are fitted inside the hub with the well known Tripp roller bearing, carried on a 4½-inch journal. Upon the inside of each wheel is bolted a 20-inch gear, fitting into a pinion eight inches in diameter that is keyed to each end of the armature shaft. This applies power to four different points, and gives traction upon all the wheels. The entire weight of the motor is supported by two rigid axles, thus overcoming the friction caused by the motor bearing upon a revolving axle.

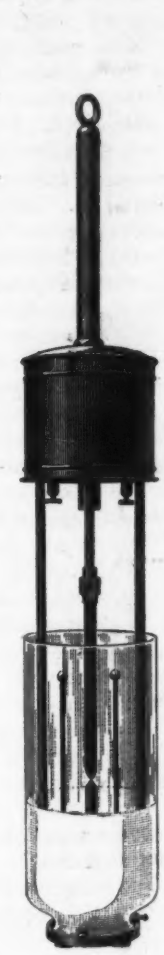
The truck is interchangeable and will swivel under either an open or a closed car. It will also take any radius of curve without interfering with the car sills.



THE TRIPP LOOSE WHEEL TRUCK.

The "New Era" Gas Lighter.

An ingenious but simple device for lighting gas by electricity has been invented by Mr. H. A. Pinkham, of Boston, who is one of the oldest men in the gas business. The



RUSHMORE LAMP. "NEW ERA" GAS LIGHTER.

appliance is now controlled and manufactured by the American Electric Company, of Boston, Mass.

This device presents a very attractive appearance, as will be seen from the illustration. All that is necessary in lighting the gas is to turn the key. This action not only moves the gas valve, but also turns the entire shaft of the apparatus.

A band or collar clasps the pillar, and in this is inserted an upright pin or mandrel, the upper end of which enters a spiral spring, an elongated point of which forms the movable electrode. The key, as shown in the illustration, stands in the position of a lighted burner. Turning back the key, the pin rides up the inclined plane of a most peculiar device for a cam, which is so constructed as to swing slightly out or in, as the case may require. At this point the gas is shut off. When the key is turned to again let on and light the gas, the cam swings out slightly and the pin rides up over the highest point of the cam, bringing the point of the movable electrode in contact with the platinum point of the permanent electrode, and as the pin slides off the cam the contact of the two electrodes is broken. The lower end of the permanent electrode is inserted in the lower collar that surrounds the pillar of the burner. The battery wire connects with the permanent electrode at the round headed screw on the post.

Financial Intelligence.

THE ELECTRICAL STOCK MARKET.

Edison General Electric Stock.—The noticeable decline in the price of this stock last week was due to the forced sales on account of loans made by Field, Lindley, Wiechers & Co., whose failure was the event of the week.

The Closing Quotations of electric stocks on Saturday, Dec. 5, 1891, in New York and Boston were:

Name of Stock.	Par.	Capitalization.	Bid.	Ask'd.
Western Union Telegraph Co	100	86,200,000	....	81¾
American Telegraph & Cable	100	14,000,000	....	....
Central and South American	100	5,000,000	....	....
Mexican	100	2,000,000	....	....
Commercial Cable Co	100	7,716,000	....	....
Postal Telegraph Cable	100	5,000,000	....	....
Edison General Electric	100	15,000,000	....	23½
Thomson-Houston Electric Co	25	6,000,000	48¾	49
" " preferred	25	4,000,000	26	26½
" International Electric Co	100	1,000,000	175	200
Thomson Electric Welding Co	100	1,000,000	55	....
" European Electric Welding Co	100	1,500,000	18	25
Westinghouse Electric Co., assented	50	7,000,000	12½	13
Fort Wayne Electric Co	25	4,000,000	12	12¾

Chicago Quotations.—Col. S. G. Lynch, broker, 153 Monroe street, Chicago, furnishes quotations on electrical stocks as follows:

TELEPHONE STOCKS.

Chicago	$220@ $224	Cumberland	$60@ $62
Central Union	51@ 52	Wisconsin	118@ 120
Michigan	81@ 83	Bell of Missouri	175@ 180
Great Southern	30@ 32	Iowa Union	20@ 22
Colorado	34@ 36	Missouri and Kansas	54@ 56
Rocky Mountain Bell	40@ 43		

ELECTRIC LIGHT STOCKS.

Chicago Arc Light and Power	$95@ $97	Chicago Edison Co	$139@$140

NEW INCORPORATIONS.

The Acme Storage Battery Company, of New York, has been incorporated with a capital stock of $1,000,000.

The Malvern Light and Power Company, of Malvern Hills, Ia., capital stock $10,000, has been formed to furnish steam power, steam heat and electric lights. J. D. Paddock and L. W. Boehner, of Malvern, are interested.

The Safety Electrical Company, of Newark, N. J., with a capital stock of $25,000, has been organized to manufacture, sell and deal in electrical supplies. A. Broemel, F. Bralson, and R. J. Brittian, all of Newark, are the incorporators.

The Litchfield Light, Heat and Power Company, of Litchfield, Ill., capital stock $50,000, has been organized to build and operate gas, electric and water works. H. H. Beach, J. B. W. Amsden and Robt. M. Foster are the promoters.

The Electric Heat Alarm Company, of Bangor, Me., capital stock $25,000, has been organized to manufacture and deal in electrical appliances. E. L. Stearns, Fred S. Palmer and Edward L. Stewart, all of Bangor, are the promoters.

The Electric Medical Appliance Company, of Chicago, Ill., with a capital stock of $50,000, for the manufacture and sale of electro-medical appliances, has been organized. Robert R. Pryor, A. A. Hall and Frank D. Thomason are the promoters.

The Bowling Green Electric Light and Power Company, of Bowling Green, O., capital stock $50,000, has been formed to furnish electric light and power. G. S. Long, Jas. Schauer, E. H. McNight, J. Henne and S. J. Miller are the incorporators.

The National Electric Brush Company, with a capital stock of $500,000, has been organized at Lynn, Mass., to manufacture and place on the market a recent invention of A. Stanton. E. F. Robinson is president, and W. M. Hill, of Salem, is treasurer.

Paragould Electric Light and Power Company, of Paragould, Ark., with a capital of $6,000, has been formed. The officers and directors are: T. H. Wyse, president; A. A. Knox, secretary; M. F. Collier, corresponding secretary, and Saul Bertig, treasurer.

The Southern Montana Telegraph and Electric Company, of Virginia City, Mont., with a capital stock of $25,000, has been formed, and will erect telegraph lines from Virginia City to Dillon, Whitehall and Norris, and conduct a general electrical business.

The Chicago Boulevard Electric 'Bus Company, of Chicago, Ill., has been formed with a capital of $100,000 to build and operate electric carriages and other vehicles to be propelled by electric batteries or other electrical appliances upon the boulevards of Chicago.

The Torresdale Electric Light and Power Company, of Philadelphia, Pa., with a capital stock of $1,000, has been organized to supply heat, light and power by means of electricity. Henry V. Nassey, Jas. Jardin, Jr., and Samuel F. Gillies are the incorporators.

The Patton Motor Company, of Portland, Ore., with a capital stock of $50,000, has been incorporated to build, buy and sell all kinds of electric motors and particularly the Patton electric motor. The organizers are W. W. Evans, Frank Dekum, John Hale and R. L. Durham.

The Morelton Electric Light and Power Company, of Torresdale Mills, Bucks county, Pa., capital stock $1,000, has been incorporated to supply light, heat and power by electricity to the public. H. N. Massey, Edwin M. Thomas and J. H. De Victor are the promoters.

The Electric Medical Process Company, of Camden, N. J., capital stock $100,000, has been formed to manufacture, use and sell or lease to others the right to use medical appliances as manufactured by the company. Its promoters are W. Cohlman, R. M. Stackhouse and H. Troth.

The Metropolitan Street Lighting Company, of Omaha, Neb., with its principal office at Omaha, capital stock $25,000, has been formed to furnish street lighting by gasoline or electricity in its various forms. Geo. J. Sternsdorff and Geo. E. Specht, of Omaha, are the promoters.

The Italian Motor and Power Company, of Portland, Me., with a capital stock of $500,000, has been formed to generate, apply and in any manner use motive power of all kinds. The incorporators are R. H. Coe, of Boston, Mass.; Michele Russe, of Boston, Mass., and D. W. Scribner, of Portland, Me.

The Electrical Reflector Company, of Rutherford, N. J., with a capital stock of $10,000, has been incorporated to manufacture, vend, introduce and market illuminated street and advertising signs and reflectors. C. Becker, M. Hofheimer, W. A. Schiffer, C. L. Gans, and L. Shafer are the incorporators.

The Astoria District Messenger and Electrical Company, of Astoria, Ore., with a capital stock of $30,000, has been incorporated to manage and operate electrical, magnetic and other machinery for transmitting messages, etc. The organizers are J. W. Crios, J. S. Urquhart, and H. B. Loman, all of Astoria.

The New England Heat Regulator and Electric Company, of Portland, Me., with a capital stock of $50,000, has been formed for the purpose of manufacturing, using and dealing in all kinds of electrical appliances. The promoters are Wm. Stopford, Jas. H. Wallis and Darling L. Trafton, all of Beverly, Mass.

The International Electric Supply and Construction Company, of San Francisco, Cal., with a capital stock of $5,000,000, has been incorporatedto do a general electrical business, etc. C. Waterhouse, Jas. Spiers, H. S. Crocker, C. O. Swanberg, C. S. Benedict, A. F. Johns, E. E. Parsons, Chas. Montgomery, and Andrew Brown are the promoters.

The San Francisco Electric Manufacturing Company, of San Francisco, Cal., with a capital stock of $1,000,000, has been formed to acquire, use and sell patents and patent rights for railroads, tramways, steamships, etc. Frederick H. Hausman, Samuel H. Brooks, Geo. B. Fraley, Wm. A. Woods and Septimus de Mayer, all of San Francisco, are the organizers.

The Shaver Telephone Company of Central New York, principal office Syracuse or Watertown, N. Y., capital stock $30,000, has been incorporated to construct and use telegraph and telephone lines through the counties of Onondaga, Oneida, Oswego, Lewis and Jefferson. Geo. L. Davis, E. M. Gates and J. B. Wise, all of Watertown, N. Y., are the organizers.

The Railway Electric Light and Heating Company, of Chicago, Ill., with a capital stock of $500,000, has been incorporated to light and heat railway cars, marine crafts and buildings with electricity, and to purchase and sell all kinds of electrical and mechanical devices, patents and inventions. The organizers are F. C. Rutan, Louis Spahn and John G. Campbell.

The Ouray & Ironton Electric Railroad, Light and Power Company, of Colorado, capital stock $800,000, has been incorporated to build and operate an electric road from Ouray to Ironton, a distance of six miles, to connect the Northern and Southern branches of the Denver & Rio Grande Railroad and to furnish light and power to mines along the route and in Ouray and Ironton.

The Des Moines Water Power and Electric Company, of Des Moines, Ia., with a capital stock of $225,000, has been organized, and succeeds the Des Moines Water Power Company. Its business will be the maintenance of a power plant, furnishing electric light, dealing in real estate and the distribution of light, heat and power. Lowry W. Goode, C. K. Mead and Fred D. Goode compose the company.

The Electric Ore Reducing Company, of San Francisco, Cal., with a capital stock of $2,000,000, has been organized to reduce refractory ores by electro chemical treatment under Monroe Thompson and other patents; to establish plants of machinery and operate same; to acquire mining claims and conduct a general milling business. Monroe Thompson, W. L. Brown, F. E. Brown, Jos. Gordon and S. B. Clark, all of San Francisco, are the incorporators.

The Little Falls Electric Light and Power Company, of Little Falls, N. Y., with a capital stock of $20,000, has been incorporated. James H. Ives, David H. Burrell, Jacob E. Fox, John W. Fitzgerald, H. W. Church, Watts T. Loomis, Jacob Zoller, Wm. F. Lansing, H. A. Tozer and others were named as incorporators. The capital stock is $20,000. The directors named for the first year are David H. Burrell, James H. Ives, H. W. Church, Wm. F. Lansing and W. T. Loomis.

The Stroweger Automatic Telephone Exchange Company, of Chicago, Ill., has been incorporated with a capital of $5,000,000. The device is the invention of A. Stroweger, of Eldorado, Kan. On the telephone shelf is a row of keys indicating units, tens, hundreds and thousands and a release key. The subscriber taps out the desired number to the central office; this number is registered on a machine, and, if all is clear, automatically connects the number called for with the wire of the subscriber.

The Astoria Electrical Manufacturing Company, with offices at 14 Dey street, New York, and factory at Astoria, L. I., has been incorporated, with a capital of $500,000. Its directors are Wm. Steinway, Edward Uhl, Edgerton R. Burpee, Hermann Kidder and Conrad N. Jordan. Among its stockholders are such men as Wm. M. McDougall, Chas. W. Spear, R. G. Dunn and Henry M. Alexander. The officers are: Conrad N. Jordan, president; Wm. Steinway, vice-president; Hermann Kidder, secretary; Wm. M. McDougall, general manager. This company will promote railroad traction, both heavy and light, stationary motor work with especial attention to mining, and general electrical work.

AFFAIRS OF THE COMPANIES.

The South Massachusetts Telephone Company is paying a quarterly dividend of $2 per share.

The Buckeye Electric Company, of Cleveland, O., has increased its capital stock from $100,000 to $250,000.

The Stanley Electric Manufacturing Company at its annual meeting held last week at Pittsfield, Mass., re-elected its old board of directors and its officers.

The Weston (W. Va.) Electric Light, Power and Water Company has increased its capital stock to $15,000, and will put new machinery in its electric light plant.

The Commercial Cable Company has declared a quarterly dividend of 1¾ per cent., payable Jan. 2, 1892. The company will also redeem £220,000 of standing debentures Jan. 15, 1892.

Increase of Capital Stock.—The directors of the Washington (Pa.) Electric Light and Power Company at a meeting held recently decided to issue the remainder of its capital stock. The entire issue is $50,000.

The Northwest Thomson-Houston Electric Company, of St. Paul, Minn., has declared the regular quarterly dividend of $2 per share on the preferred stock, payable Dec. 15. Books will be closed from Dec. 7 to 16 inclusive.

Crocker-Wheeler Dividend.—A dividend of five per cent. was paid the stockholders of the Crocker-Wheeler Motor Company Nov. 15 past. A reserve fund was at the same time created, and the balance of the profits was set aside for this fund.

The Gaynor Electric Light Company, of Louisville, Ky., will continue in business. At a recent meeting of the stockholders a proposal to raise a loan of $20,000 was favorably received. This amount will enable the company to carry on its business as before.

The United Electric Securities Company has made the fifth call for $80,000 of its collateral trust sinking fund 5 per cent. bonds. Including this call, the company has retired $283,000 of its first series of $500,000 bonds and $52,000 of its second series of $500,000.

The West End Street Railway, of Boston, Mass., has declared its regular dividend of five per cent. upon the common and four per cent. on the preferred stock for the half year. The dividend is payable Jan. 1 to stock of record Dec. 19, the transfer books to be closed between those dates.

The Cedar Rapids (Ia.) Electric Light and Power Company at a recent meeting of the stockholders voted to increase the capital stock from $75,000 to $150,000. It was also determined to issue $25,000 of this increase at once and of that amount $15,000 was subscribed on the spot.

Increase of Capital.—The Marietta, Ga., Electric Light Company at its annual meeting held recently voted to increase its capital stock $10,000, and to put in an incandescent lighting plant. Mr. C. Wallace, Jr., has agreed to take the additional stock and to assume the management of the company. It is expected that the new plant will be ready for operation by Jan. 1.

Supply Companies Combine.—The electrical supply companies and contractors of St. Louis, Mo., have formed a combination for the purpose of maintaining uniform prices and rules for the government of their trade. The organization was effected on Monday night, and the following officers were chosen: R. C. Wolfrom, president; Ed. E. Cook, vice-president; R. V. Scudder, secretary, and Robert Dodsworth, treasurer. The combination is known as the St. Louis Electric Exchange, and is composed of the leading dealers in electrical supplies. It is claimed that owing to the large number of firms starting in the business during the past two years, the prices are demoralized by constant cutting.

The Westinghouse Reorganization.—In answer to a question about the completion of the reorganization of the Westinghouse Electric and Manufacturing Company last week, Paul D. Cravath, the attorney for the company, made this statement: "The completion of the plan of reorganization adopted by the Board of Directors April 14, 1891, and by the stockholders July 15, 1891, is announced. The stockholders have responded with substantial unanimity to the call for the surrender of 40 per cent. of their holdings for the use of the company. Of the stock at the disposal of the company, $4,000,000 has been converted into 7 per cent. preferential cumulative stock, and the balance into 'assenting stock' entitled, after the preferred stock, to a 7 per cent. annual preference. Provision has been made for the company's debt and working capital by the sale at par of $3,000,000 of the preferred stock, for which payment in full has been received. The company has acquired almost all of the stock of the United States Electric Lighting Company and the Consolidated Electric Light Company (commonly referred to as the 'leased companies'), so that the fixed charges formerly incident to the leases of these companies are now substantially obliterated, and the consolidation of interests thus effected has rendered possible a great reduction in general expenses. The saving in interest upon debt, rentals and other fixed charges thus effected by the reorganization amounts to more than $400,000 per year. All this has been accomplished without increasing the company's capital stock. The reorganization has been effected without litigation and without interruption to the business, its three factories having been kept in continuous operation."

Special Correspondence.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL WORLD,
167-177 TIMES BUILDING, NEW YORK, Dec. 7, 1891.

Will the Messenger Companies Unite?—A rumor which seems to have considerable foundation in fact has been in circulation for a week or more that the American District Telegraph Company and the Mutual Telegraph and Messenger Companies are about to form a consolidation.

Mr. E. S. Mendels, formerly general manager of the Universal Arc Lamp Company, is associated with the firm of Messrs. Marquand & Skehan, of 16 Broad street, this city, whose business is the buying and selling of investment bonds and stocks. Mr. Mendels will probably pay special attention to electrical securities.

A Holiday Display.—The window decorations of Macy & Co., Fourteenth street and Sixth avenue, N. Y., as usual during the holiday season, are attracting delighted crowds by their elegance. The most attractive portion of the show is the cut glass display in the windows on the Fourteenth street side. The arrangement of the exhibit is a unique one, and is made more brilliant by the effective grouping of 53 incandescent lights installed by McLeod, Ward & Co., of 91 Liberty street. This firm is also busy installing 10 Ward arc lamps in the dry goods store of Hearn & Co., and is unusually busy in all lines of construction work which it carries on. L. H. H.

NEW ENGLAND NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
Room 28, Hathaway Building, 620 Atlantic Ave.,
BOSTON, Mass., Dec. 5, 1891.

Mr. A. Martin has resigned the superintendency of the Gloucester Street Railway.

The Newburyport Car Manufacturing Company has just finished five electric snow plows for Worcester, Mass., and three for Lawrence.

The Wainwright Manufacturing Company has recently made a large sale of its corrugated copper expansion joints for the Stanford University of California.

Mr. James F. Shaw, of the Newburyport (Mass.) Car Manufacturing Company, is bringing out a self-lubricating trolley wheel for which many orders have already been received.

Albert and J. M. Anderson are fitting up a new draughting room and private office which will give them largely increased facilities for their business, which has been increasing very rapidly.

New Double Deck Car.—A trial of the new Pullman double deck car was made on the West End tracks last week and proved entirely successful. The car was much admired by the thousands that saw it.

South Boston, Mass.—Property has been leased by the Thomson-Houston Electric Company to be used for the manufacture of certain castings used by the company in the construction of electrical apparatus.

J. Bradford Sargent, agent for the "Stirling" boiler, has opened an office at 620 Atlantic avenue, Boston. He reports a large demand for these boilers. Of the large number in use not one has failed to give satisfaction.

The Newton Rubber Company is doing a large business at present in storage battery cells and mechanical and rubber goods for electrical use. Its facilities for this business are excellent, as the company expended a large sum in putting in special machinery for this trade.

Lynn, Mass.—The Thomson-Houston company contemplates moving its power plant to less expensive land by the seashore. It will thus secure fuel much cheaper, and would have a wharf of its own where coal vessels could unload. The power could be transmitted to the factory by cables.

The Germania Electric Company has recently installed a plant for the Fahys Watch Case Company, Sag Harbor, L. I. The dynamo is the well known "Germania" and is used for the purpose of running motors throughout the factory. The general demand for these machines is increasing very largely.

Search Light Manufacturing.—The 26-inch search lights of the Thomson-Houston company will hereafter be made at the Middletown (Conn.) factory. This portion of the electrical business has been extensive during the past year, and nearly all liners and coasters of any importance have been equipped with them.

The Beacon Vacuum Pump Company has been meeting with remarkable success with its new process of manufacturing incandescent lamps. The time saved by this process is very remarkable, and it is claimed that repeated tests have shown that the company's lamp has a long life, and is in every way very satisfactory.

The Connecticut Electric Lighting Association met in New Haven recently for its annual meeting. The following officers were elected: President, James English, New Haven; first vice-president, J. A. Hadley, Meriden; second vice-president, James P. Stow, Middletown: treasurer, John C. English, Bridgeport; secretary, A. M. Young, Waterbury; members of executive committee, F. F. Fuessmich, Torrington, and L. C. Whitney, New Britain.

The National India Rubber Company is meeting with decided success in the sale of its seamless insulated wire protected by tape and braid. Users of covered wire are coming to the conclusion that such must be protected by tape in order to wear well. This company has just taken a large contract of subway work from the East River Electric Light Company, of New York. The business of the company has increased so largely that it will enlarge its plant to four times its present capacity.

New England Electric Club.—A movement is being actively pushed by a number of prominent electrical people for the formation of what is to be called the New England Electric Club, to take the place of the defunct Boston Electric Club. The intention is to have some well appointed club rooms centrally located, which are to include café, billiard-room and buffet as well as sleeping rooms. The idea seems to be very popular, as nearly 100 have already signed the call and signified their desire to become charter members. There is no reason why such a club should not be an immediate success and it should easily attain a membership or 200 or more. C. A. B.

WESTERN NOTES.

Branch Office of The Electrical World,
465 The Rookery, Chicago, Dec. 5, 1891.

Mr. N. W. Mixer, of the Western Electric Company, Chicago has secured the contract for 3,600 incandescent lights for the Ashland Block.

Mr. S. G. Booker, the general manager of the Fidelity Carbon Manufacturing Company, of St. Louis, Mo., is a welcome visitor in Chicago this week.

Adrian, Mich.—The Gilliland Electric Company will build a large addition to its present plant, and will employ 200 men when the addition is finished.

Muscatine, Ia.—The Citizens' Electric Light and Power Company's board of directors held a meeting recently and the report presented showed the business to be in good condition and constantly increasing.

Nevada Agency of the Edison Company.—The Edison General Electric Company has made Reno, Nev., its principal place of business of the company for that State, and has appointed Mr. Frank Bell the general agent and attorney for the company.

Julius Andrae, Milwaukee, Wis., has received the contract for the wiring and complete installation of the necessary electrical apparatus in the handsome residence now being erected in Los Angeles for Mr. T. D. Stimson. This includes automatic fire alarm, electric gas lighting, as well as electric lighting, etc.

Mr. John J. Swenie, for years the genial secretary of City Electrician Barrett, and well known to all the fraternity, has resigned that office and is now settled in his new rooms at 87 Washington street, Chicago, where he will devote all his time to the practice of law. Mr. Swenie's affability will not only bring him many clients but also have more or less influence in convincing judge and jury that his side of the case is the right one.

Two Electric Light Stations Destroyed.—The Chicago Arc Light and Power Company's big station on Washington street and the river was almost destroyed by fire on Monday evening, and several employés were more or less burned while attempting to extinguish the flames, the cause of which has not been definitely determined. A portion of the machinery, including a large number of the dynamos, was not seriously injured, and customers will soon be furnished with light, as all the available power in the immediate vicinity is being temporarily rented. The fire caused great inconvenience to down town merchants, where nearly 2,000 arc lights were supplied. Tuesday night the plant of the Central Electric Light Company, 185 Dearborn street, Chicago, was nearly destroyed, thus shutting off the current from about 3,000 incandescent lamps supplied from the Slattery alternating system. This latter fire is said to be due to the overheating of the pine flooring above the boilers.

F. de L.

Kansas City, Mo., Dec. 4, 1891.

A. B. Richards, manager of the Postal Telegraph Company, is east on a business trip.

H. M. Grant, general agent of the Vulcanized Fibre Company, Wilmington, Del., was here a few days ago.

Geo. H. Boswell & Co., of Garnett, Kan., have secured a franchise for an electric light plant at Osawatomie, Kan.

W. H. Blood, Jr., of the Franklin Electric Company, returned recently from Red Oak, Iowa, where he went to superintend the opening of the new electric light plant at that point. He is well pleased with the plant and pronounces it a success in every particular.

An Otis Electric Elevator is being placed in a large dry goods store at 1,002 Main street, making the second electric elevator now in use in this city. Much interest is being manifested on the part of those who use them, and it is likely that several of our office buildings will shortly discard hydraulic service for the new power.

The Western Storage Battery Company has contracted for all engines and electrical supplies, and placed the contract for various apparatus in the hands of Thos. F. Clohesy. Detroit generators and motors will be used, and Bradbury & Stone will furnish stamps, dies and stones. The company will employ about 20 men at the start, and expects to be turning out batteries in a very short time.

H. D. E.

SOUTHERN NOTES.

Norfolk, Va., Dec. 5, 1891.

Bastrop, Tex.—The city is contemplating the erection of an electric light plant.

Algiers, La.—The Algiers Ice Manufacturing Company will erect an electric light plant.

Huntsville, Tex.—The erection of an electric light plant at an early day is contemplated.

Louisville, Ky.—The operations of the Gaynor Electric Company will continue on a loan of $20,000.

Rome, Ga.—Work is about to begin on the construction of an electric car line. Bonds to the amount of $100,000 have been issued.

Staunton, Va.—The City Street Car Company's line, it is reported, is to be sold. The purchasers intend to convert it into an electric line.

Alexandria, Va.—A charter for the Alexandria & Fairfax Electric Railway has been secured by Western parties, who will build the road.

Velasco, Tex.—The erection of an electric power plant to operate its railway is contemplated by the Velasco & Surf Side Railway Company.

Corsicana, Tex.—The street railway is reported as having been purchased by New York parties, who will change the same to an electrical system.

Baltimore, Md.—A $1,000,000 electric light company is in process of formation, with W. P. Hix, of the Edison Electric Light Company of New York, as principal organizer.

Baltimore, Md.—The Rapid Transit Railway Company, composed of Harry W. Rusk, J. P. R. Polk, R. L. Preston and others, have received authority to construct a street railway and operate same by electricity or other methods.

Ellicott City, Md.—Owners of the McCrea mill property are negotiating with Joseph Schreiber, of Baltimore, who desires to purchase and utilize water power for the manufacture of electricity to supply the city with light and power.

New Berne, N. C.—The franchise of the city to construct, maintain and operate an electric street railway was granted by the board of City Council to W. C. Clarke, of Wakefield, R. I., he to file a bond of $1,000 and begin work in six months.

Baltimore, Md.—Contract for grading and track laying on the 3½ miles of electrical railroad of the South Baltimore & Curtis Bay Railroad Company has been sublet to a Mr. Flannery, and for the ties to a Mr. Mewshaw. Work has been commenced.

Ronceverte, W. Va.—The Electric company, recently chartered, has the privilege of operating electric railroads, erecting electric light plants, etc. This company, consisting of E. C. Best, of Ronceverte, with Baltimore, Md., parties, has purchased the electric light plant of the Ronceverte.

Point Pleasant, West Va.—The Point Pleasant Electric Light and Power Company has been incorporated, with D. S. Snyder, now operating an electric light plant, F. N. Durbin, G. E. Milligan, of Parkersburg, and others. The capital stock will not be less than $8,000 nor more than $50,000.

Washington, D. C.—Work has already commenced on the Washington & Arlington Electrical Railway. Work will also begin on the bridge across the Potomac River as soon as the plans are approved by the Secretary of War. Plans for this bridge will be furnished by Job Abbott, of New York City.

V. N. B.

CANADIAN NOTES.

Ottawa, Dec. 5, 1891.

St. John, N. B.—Arrangements are being made to light the lunatic asylum and annex with incandescent lights.

Ottawa.—The Ottawa Electric Street Railway Company which has secured a majority of the stock of the Ottawa Street Railway Company (horse car line), will apply to the Ontario Legislature for the power to equip the old line with electrical cars.

Ottawa.—The Chaudière Electric Light Company is placing its incandescent light system in Eddy's new paper factory, and have also received orders for eighty lights respectively for Brading's Brewery, the Rideau Street Convent and Mortimer & Co.

Brantford.—A proposition entailing an outlay of $60,000 has been submitted to the Brantford Council leading toward the establishment in Brantford of a system of electric street cars. The company asks for an exemption from taxation for 10 years and a franchise for 30 years, with the option of purchase by the city at the end of that time.

Ottawa.—The Standard Electric Company has asked the Ottawa Electric Light Company for particulars as to the claim for $400,000 which the latter company has made. Senator Clemow, vice-president of the Ottawa Electric Company, is called on to specify the machinery at the Chaudière, which the other company is using, and to the use of which his company claims the absolute right.

Niagara Falls.—Superintendent Wilson, of the Victoria Park, says that an electric railway between Chippewa and Queenstown will positively be constructed the coming season, and that very likely when the line is finished a line of boats will be put on in connection between Toronto and the northern terminus. When asked if the electric road was a part of the English syndicate scheme, he replied that he could not answer that question for a week or so.

Guelph.—The by-law to authorize the mayor to enter into a contract with the Guelph Gas Company for electric lighting has passed the City Council. The contract provided for 75 lamps, instead of the present 21, of 2,000 nominal c. p., of the most modern kind. They are to be lighted 290 nights in the year, and any other nights that the chairman may direct. The cost is to be 24½ cents a night for each light. The agreement is for five years. The committee has an option of increasing the lights to 100 at the same rate.

Regina, N. W. T.—Notice is given that application will be made at the ensuing session of the legislature for an act to confirm the powers conferred on the Bell Telephone Company, of Canada, by the Acts of the Parliament of Canada, in regard to those portions of the company's works and undertaking which are local, and to make the said company a corporation under the laws of the Northwest territories, and to construct and operate local telephone lines for the transmission of messages between any cities, towns and villages in the territories.

Toronto.—The Canadian Electrical Association was organized at Toronto on Thursday last, in Shaftsbury Hall, with the following officers: President, J. J. Wright; first vice-president, H. J. Dunstan; second vice-president, John Carroll; secretary and treasurer, C. H. Mortimer. Executive committee: H. O. Fisk, A. W. Johnston, S. J. Parker, A. B. Smith, A. Thompson, Thomas H. Wadland, A. A. Wright (Renfrew), and John Yule. It was decided the first annual meeting of the association should be held on the second Tuesday in June at Hamilton. Almost every branch of the electrical business was represented at the meeting.

Windsor.—When the electric street railway was being built in Windsor there was some friction between the Council and company about running powers on the streets, and pending a settlement the mayor ordered work to be stopped, and arrested four men, who were subsequently released on bail. These men now propose to have a balm for their wounded feelings, and their solicitor, Sol. White, has served notices on Mayor Fleming, Sergt. Willis and Police Officers Mahony and Lister, that they would at once begin suit for false imprisonment. Their names are Horace Bisby, Henry Pratt, John Gining and John Lillies, and they want $5,000.

Ottawa.—Mr. Coatsworth, M. P., Toronto, was in Ottawa last week to interview the government in connection with the seizure of a quantity of valuable electric light plant at St. John, N. B. The machinery was imported by W. J. Morrison from a firm at Fort Wayne, Ind., and it was alleged by a rival Canadian concern to have been entered at the Customs for a lower figure than the actual value. The question as to whether the manufacturers allowed the importer too large a figure is now being considered by the Department of Customs. The case is an important one, in that it involves the validity of entry of about half a dozen other electric light plants imported by the same parties, and now in use in Woodstock, Fredericton, and several other towns in New Brunswick. Mr. Coatsworth had an interview with the Hon. Mr. Bowell upon the subject.

Hamilton, Ont.—A number of citizens of this city have a project on hand to build a street railway line from Hamilton to Beamsville, to be run by electricity on the trolley plan. They propose that the new line shall be run from the H. & D. terminus on Ferguson avenue, along Manie street, until it joins the county road at the Saltfleet line, which it will follow to Beamsville. The places touched could be Bartonville, Stoney Creek, Winona, Grimby, Grimby Park, and Beamsville, in addition to being contiguous to Smithsville, Tapleytown, Elfrida and Tweedside. The scheme has been talked of before, but the use of ordinary engines has blocked it. Now with the use of electricity this objection is removed. The feeling in favor of the road is strong, and as soon as the company is formed the project will be pushed ahead. It is said that the Hamilton Steamboat Company may be interested, and in this way Toronto will be connected.

ENGLISH NOTES.

London, Nov. 25, 1891.

Lane-Fox Distribution Patent.—This patent, which has now been narrowed down to a claim for distribution with batteries in parallel with the lamps, and which was first heard of by the electrical industry some 18 months ago, continues to make its appearance from time to time in the law courts. From what takes place there it may be surmised that the companies threatened are making use of every possible legal quibble for delaying the trial of the action brought by Mr. Lane-Fox. The revival of this long dormant patent has given rise to considerable irritation and there are few people who deprecate the employment of legal obstruction in furtherance of the freedom of the industry.

A Continuous Current Transformer Central Station.—A central station which is now being put down by the Oxford Supply Company will no doubt be of interest to electrical engineers. The plant will consist of separately excited Elwell-Parker continuous current machines having an output of 80 ampères and 1,050 volts. The generating station being situated over three-quarters of a mile from the centre of the area supplied, a system of continuous current transformer substations has been adopted. From the generating station high pressure cables will run to a "switch" station situated in the centre of the district to be lighted. From this "switch" station the whole of the distribution and regulation of supply will be effected. At the "switch" station and at various substations there will be continuous current transformers supplying current at a pressure of 107 volts to an ordinary two-wire network, which it is proposed at a later period to convert into a three-wire system. An efficiency of 90 per cent. will, it is estimated, be obtained at full load, with 80 per cent. at one-third load.

The Siemens "Cable" Transformer.—In May last in the course of the discussion on Dr. Fleming's exhaustive paper on the "Ferranti Effect," which was read before the Institution of Electrical Engineers, the author referred to some experiments at Messrs. Siemens' works, in April, 1890, in connection with the effect of varying the capacity of the secondary of a closed circuit transformer. As will perhaps be remembered, this experiment showed that not only were the volts in the secondary multiplied by about 3½, but the ratio of transformation of the transformer increased in a straight line from its normal figure of 40 to nearly 60, as the capacity of the secondary circuit was increased from zero to about seven microfarads. Mr. Alex. Siemens thereupon stated that his firm had constructed an open circuit transformer of the "cable" type, and he was able to say from experiments made with this particular pattern that the alteration in the form of transformer resulted in the ratio of transformation remaining absolutely the same, while the capacity of the secondary was altered from zero to one microfarad. This "cable" transformer has now been placed upon the market, and is, as its name denotes, nothing more than a long coil of soft iron wire rope overwound with the primary and secondary circuits. This overwound wire core is cut off in a suitable length, coiled into a helix and placed in a skeleton stand. Owing to this arrangement there is large cooling surface, and it is claimed that a 150-h. p. transformer of this open circuit type has an efficiency of 91 per cent. at full load, 93 per cent. at half load and 90 per cent. at one-fourth load, and that it is self-regulating as regards terminal pressure to within three or four per cent.

News of the Week.

THE TELEPHONE.

Austin, Minn.—A telephone exchange is projected.

Eufala, Ala., has a telephone exchange now in operation.

Baton Rouge (La.) to Hope Villa.—A telephone line is projected between these two points.

Kalamazoo, Mich., to Vicksburg.—A telephone line between these two points is in process of construction.

Waterville, Me.—The New England Telephone Company is extending its lines from this place to North Vassalboro.

Wheeling, W. Va.—The telephone company is asking permission of the City Council to place its wires underground.

Mt. Pleasant, Pa.—A telephone exchange is to be established, as a sufficient number of business men have agreed to give it their support.

From Manitou to Pike's Peak.—The telephone line between these points has just been completed. It is said to be the highest telephone line in the world, the two points being respectively 6,500 and 14,100 feet above the sea.

From Baker City to Canyon City, Ore.—A telephone line is projected between these two points, to include a number of way stations. Should the telephone line not be built it is probable that a telegraph line will be constructed.

Crossville, Tenn.—The G. & O. R. Telephone and Telegraph Company has been reorganized, and owing to the resignation of the

old officers and directors, the following gentlemen have been elected directors for the ensuing two years: G. C. Stevens, Arthur J. Forbes, John Q. Burnett, John H. Cother and J. S. Cline.

The Long Distance Telephone Line to Cleveland, O., has been completed and will be of great advantage to patrons of the Erie Telephone Company's Cleveland exchange. Arrangements have already been completed at Cleveland for furnishing the metallic circuit facilities so that the subscribers at Cleveland can converse readily with their correspondents in all parts of the country that are connected with the long distance system.

THE ELECTRIC LIGHT.

Richmond, Ind.—The Fulton Steam Boiler Works have put in an isolated electric light plant which furnishes both arc and incandescent lights for the factory.

Quakertown, Pa.—The citizens are agitating the subject of establishing an electric light plant. The question is to be decided at an election in the near future,

Salt Lake City, Utah.—The Electric Light Company is adding a new Thomson-Houston incandescent machine to its plant. This will increase the capacity 1,300 lights.

Urbana, Ill.—New dynamos and engines are being installed at the electric light plant of Messrs. Wright & Sons to provide for the increased demand for incandescent lights.

Duluth, Minn.—The Phœnix Electric Light Company has closed a contract for an isolated plant having a capacity of 125 lights for the brewery of Messrs. A. Fitger & Co.

Wheeling, W. Va.—The Council has rejected the proposed ordinance giving to the Edison Electric Light Company of that place the privilege of going into the street lighting business.

Ely, Minn.—Although the City Council has voted to issue bonds for the purpose of establishing an electric light plant, a movement is now on foot to secure a franchise for a private company.

Oregon City, Ore.—An electric light franchise has been granted to Messrs. J. W. & A. E. Carlson, of Portland. The city agreed to take 12 arc lights for five years and to pay the company $150 per month.

Havana, Ill.—Of the bids received by the City Council for electric lights, that of Mr. Snyder, of Mt. Pulaski, was the lowest, and was accepted by the Council. The contract, however, has not yet been let.

Cannon Falls, Minn.—Some Northfield parties are negotiating for an electric light plant, and as considerable interest is manifested it is probable that the plant will be established in the near future.

Texarkana, Tex.—The Texarkana Electric Light Company has been sued for $20,000 by the administrator of the estate of a negro who is alleged to have recently been killed by one of the company's electric light wires.

Perry, Ia.—The City Council has granted a franchise for the establishment of a system of electric lights. The franchise was granted to J. M. Buker, the local superintendent of the Milwaukee & St. Paul Railway.

Kalamazoo, Mich.—At the recent meeting of the directors of the City Electric Light Company, Mr. G. I. Goodenow's resignation as secretary of the board was accepted, and Mr. William Shakespeare was elected to fill the place.

Phillipsburg, Mont.—Bowen Brothers & Thompson have sold out the electric light plant to Messrs. Durham & Cox for $18,000. It is the intention of the new proprietors to add several thousand dollars worth of new machinery for the purpose of supplying arc lights.

Columbus, Ind.—The City Council has granted to Henry C. Bayling a 10-year franchise for an incandescent electric light plant. It is said that Mr. Bayling has associated with him some Chicago capitalists, and that the plant will be in operation this month.

Murfreesboro, Ill.—The contract for the city's electric light plant has been awarded. According to the agreement the city will pay $1.000 at the completion of the plant, and $2,000 per year with seven per cent. interest until the plant is owned by city. The total cost of the plant will be $50,425.

Rochester, N. Y.—The Electric Light Company, owing to an increase in business, has just added a 500-h. p. steam engine to its plant. The engine was built by the Fishkill Machine Co., of Fishkill Landing, N. Y. The capital stock of the company has recently been increased from $100,000 to $200,000.

Duquesne, Pa.—An electric light company has been formed and will make an early application for a charter. The following officers have been chosen: G. W. Allebrand, president; William Davis, vice-president; N. G. Conlin, treasurer; directors, J. R. Wyhe, H. L. Black, N. G. Conlin, C. F. Kayser and J. G. Neverline.

THE ELECTRIC RAILWAY.

Evansville, Ind.—The street railway company is making preparations to change its horse car line into an electric line.

Little Rock, Ark.—The City Electric Street Railway Company has successfully started the first electric motor cars in the city.

Sacramento, Cal.—Mr. J. H. Henry, of San Jose, and Mr. L. L. Lewis, of Sacramento, have purchased the R. S. Carris horse car system and will at once equip it with the overhead electric system.

Norwich, Conn.—The Norwich Street Railway Company will petition the Common Council at its next meeting for permission to use electricity as its motive power. An extension of the line is contemplated.

Extending Its Line.—The Electric Railway Company, of Savannah, Ga., of which Mr. J. S. Collins is president, and Mr. J. W. MacFarland, superintendent, is going to extend its lines four miles. The work will be done at once.

Duquesne, Pa.—A number of citizens have arranged to apply for a charter for an electric light company to do business in Duquesne. Among those interested are H. H. Swaney, Esq.; Dr. T. L. White, Thomas Reynolds, G. L. Reiber, James E. White and Henry Reiber.

Haverhill, Mass.—The old scheme for an electric road from Haverhill to Lawrence has been revived, and the preliminary surveys are being made in the interests of the new construction company, in which it is said ex-Governor Ames and Fred L. Ames are interested.

New Orleans, La.—The City Council has passed an ordinance authorizing the New Orleans & Carrolton Railroad Company to use electricity as a motive power to operate its cars over the different streets covered by its contract with the city of New Orleans of Aug. 7, 1882.

Electric Railway for Lynn, Mass.—President A. F. Breed, of the Lynn & Boston Railway Company, says the 70 miles of track in this city will be equipped with electrical apparatus within another year. President J. A. Towns, of the Belt Line, says that the project to unite Boston, Lynn, Salem and Newburyport is practicable and may be carried out in the near future.

Fenders for Electric Cars.—An order came before the Boston Board of Aldermen at their last meeting that the regulations on this subject be amended so as to read as follows: Section 21—No person having the control of the speed of a street railway electric car shall allow such car to go in any part of the city at a rate of speed any faster than seven miles an hour until the said car is equipped with proper and suitable fenders or guards for the protection of the public against accident; nor in turning a corner in any part of the city at a rate of speed faster than four miles an hour. The order was referred to the committee on railroads.

Railway Motors in a Fire.—The recent burning of the car barns of the Second Avenue Passenger Railway Company, of Pittsburgh, Pa., demonstrated an interesting fact in connection with the electrical apparatus. In making an investigation of the wreck, in order to discover whether there might be anything left to be again used, the railway company found that, of the various electrical equipments which were operated on the cars of its like, the motors of the Westinghouse Electric and Manufacturing Company were the only ones that could be utilized again, they being in a condition somewhat similar to that of a good safe which has passed through a fire. The Second Avenue Company has purchased of the Westinghouse company complete equipments to replace all of those that were destroyed by the fire.

The Pittsburgh (Pa.) Traction Company, at its annual meeting re-elected the old board of directors, and George L. Elkins was chosen to the place made vacant by the death of William H. Kemble, of Philadelphia. The board is as follows: William L. Elkins, P. A. B. Widener, George L. Elkins, Philadelphia; George W. Elkins, Thomas S. Bigelow, J. Z. Wainwright and George C. Wilson, Pittsburgh. The following are the officers of the company: President, George W. Elkins; vice-president, Thomas S. Bigelow; secretary and treasurer, J. G. Traggard. The passenger report of the road shows that 9,479,994 were carried during the year just closed, as against 8,276,174 carried the previous year. The same officers given above were elected at the meeting of the Central Transit Company. The annual statement shows that the net earnings of the company for the year were $84,000. This statement covers the period ending Oct. 31.

The Second Avenue Passenger Railway Company of Pittsburgh, held its annual meeting last week, and a project was ratified to rebuild the old Birmingham line which crosses the Monongahela River at Tenth street. This line is owned jointly by the Second Avenue Company and the Pittsburgh & Birmingham Company. The small horse cars with which the Tenth street bridge is at present equipped will be turned into electric cars. The laying of the new tracks will save the Second Avenue line a completely new track. The Pittsburgh & Birmingham line has given its consent to the plan. The resignation of C. G. Milnor, secretary, was received. George C. Wilson was elected in his place on the board of directors, while J. C. Reilly was chosen secretary. The other directors are J. D. Callery, who is president, W. J. Burns, general manager, and W. B. Callery. It was reported that $33,000 worth of improvements had been made during the year, and that the road's business had paid for all these. The company expects to heat its cars with electricity or steam this winter. Two new contrivances for this purpose are being tested.

The Citizens' Traction Company, of Pittsburgh, Pa., at the annual meeting of the stockholders elected the following board of directors: James Verner, John G. Holmes, James J. Donnell, John B. Jackson, C. L. Magee, H. S. A. Stewart and John Gripp. The board will meet in a few days for organization, when the old officers will be re-elected. They are: John G. Holmes, president; H. S. A. Stewart, vice-president, and N. Holmes, treasurer. The comparative exhibit of passenger business of the road for the year ending Nov. 1 last, as reported at the meeting, is as follows:

	1891.	1890.	Gain.
Butler street	5,306,788	5,080,110	226,678
East Liberty	6,394,639	5,937,581	457,058
Sharpsburg	761,297	585,553	175,714
Frankstown	46,245	57,258	8,957
Total	12,508,969	11,640,532	836,437

Total receipts, including $300,000 from new stock, $962,223.31. The total expenditures, including Sharpsburg electric construction and equipment and dividends, were $905,741.74. Cash balance Nov. 1, 1891, $56,481 57. It is announced that the Sharpsburg electric line would be opened for business on Dec. 1. Directly after the meeting of the Citizens' Traction Company the annual meeting of the Citizens' Passenger Railway Company was held and the old board of directors elected as follows: James Verner, Joseph S. Browne, James J. Donnell, C. L. Magee and H. S. A. Stewart.

LEGAL NOTES.

Lynchburg, Va.—A suit has been entered here in the United States Court by the Edison General Electric Company, of New York, against the Charlottesville and University of Virginia Electric Light and Gas Company for $5,000.

The Electrical Accumulator Company Enjoined.—A perpetual injunction has been issued by the United States Circuit Court for the Southern District of New York against the Electrical Accumulator Company and its officers, restraining the company from making storage batteries in infringement of the patents of Charles F. Brush, now owned by the Consolidated Electric Storage Company, the successors of the Julien Electric Company.

Powers of an Electric Light Company.—The New York Revised Statutes provide that the business of a manufacturing corporation must be carried on by a board of trustees, but that the latter may appoint such subordinate officers and agents as the conduct of the business may require. The New York Court of Appeals, Second Division, in construing this provision, held (Sheridan Electric Light Company *vs.* Chatham National Bank) that the trustees of a company owning electric light patents and manufacturing electric supplies were authorized to appoint an executive committee of their own members to contract with companies in different States for the exclusive use of its lights and dynamos in those States, and that where the committee had been given power to make such contracts it had the power to draw the money on all checks that might be issued in payment thereunder.

Canadian Telegraph Suit.—The Supreme Court of Canada has finally rejected the appeal by the Great Northwestern Telegraph Company in its suit against the Montreal Telegraph Company, claiming a reduction in the amount of rent agreed to be paid by the former to the latter for the use of its lines and plant, the rent being eight per cent. on the capital of the Montreal Telegraph Company. The action was based on the claims that from the establishment of the Canadian Pacific telegraph system the revenues of the Great Northwestern had been greatly reduced, and further that they had been deprived of certain lines previously operated by the Grand Trunk company and covered by the lease referred to. The Superior Court dismissed the action on the ground that the suit for interference should have been brought against the interfering company and not against the Montreal Telegraph Company.

PERSONALS.

Mr. A. L. Carner, formerly Western representative of the Universal Arc Lamp Company, is now New York salesman for the Hunt Engineering Company of this city.

Mr. Allen R. Foote, the former secretary of the National Electric Light Association, contributed an article on "Degradation by Pensions" to the December number of the *Forum*.

Mr. C. P. L. Noxon, who has been with the Electrical Engineering and Supply Company, of Syracuse, N. Y., has taken a position in the laboratory of Queen & Co., of Philadelphia.

Mr. A. L. Eugene, manager of the Western Union Telegraph Office, at Bridgeport, Conn., has resigned the position to enter upon some other line of business. He has occupied the position of manager for eight years.

Mr. J. C. Pinkerton has resigned the position of president of the Wayne Electric Light Company. The office will not be filled until the election in July. Vice-President James W. Cooper will perform the duties of the office in the meantime.

Mr. H. H. Harrison, for years manager of the Edison General Electric Company's supply department, and more recently with the Lieb Machine Works, has accepted a position with the Thomson-Houston Electric Company, looking after its supplies. Mr. Harrison's long experience in this work, and his acknowledged ability as a salesman, will give him a good start.

MISCELLANEOUS NOTES.

The Electrical Club of Brooklyn's Mechanical Engineers is a recently organized club for the purpose of studying electrical science. Prof. John P. Holder, of Brown's Business College, and an electrician of the Metropolitan Telephone and Telegraph Company, of 18 Cortlandt street, is now delivering a course of illustrated lectures especially prepared for the members of the club. The club holds its meetings twice a week, Tuesday and Thursday evenings, in Muggy's Hall, corner of Fulton and Bridge streets, and although at present the class is limited to 30 members, they hope to enlarge it to double the number after Jan. 1, having already had a number of applications for admission. The members and officers of the club are: Prof. John P. Holder, electrician; W. A. Harris, president; Jas. Canning, secretary; W. R. Burger, treasurer; Mark Alvenius, sergeant at arms; Isaac McCullough, Neill Gillespie, T. L. Peterson, Emil Wurmuth, Hugh Doherty, Walter Hutchison, M. J. O'Rourke, Thos. J. Daly, Frank Norwood, Jos. Gelshon, Charles Kerns, M. Gustaval, Wm. McGuire, Wm. D. Cole, John Mahoney, Thos. H. Cole, John Kelly, Wm. P. Thompson, Jas. Hawkes, Jules Jooss, Jas. McGough, G. Cottinghann, Jos. Mitchell, John Krytchen and John Fields.

Industrial and Trade Notes.

Messrs. Barclay & Sharpe, 549 The Rookery, Chicago, report good business in the line of steam plants while the outlook for the closing of several orders for the Woodbury engine and the Radway feed water heater is very encouraging.

Peerless Compound.—For the perfect lubrication of street railway motors, the Peerless compound manufactured by George P. Jones & Company, No. 708 Main street, St. Louis, is highly commended by street railway superintendents who are using it exclusively.

Isolatine Paint.—The Illinois Electric Material Company, Chicago, is receiving many orders for its Isolatine paint, that is said to be a perfect preservative for all exposed work, forming a flexible lacquer not affected by atmospheric changes. It also gives excellent results as a superior substitute for liquid gutta-percha, paraffine and shellac.

Insulating Tape.—Mr. George H. Meeker, manager of the Chicago office of the New York Insulated Wire Company, has received some most flattering letters from users of the Grimshaw improved armature insulating tape who have employed it in re-winding armatures, more especially the armatures of street car motors, as its peculiar adhesiveness is not affected by extremes of temperatures.

The Washington Carbon Company, of Washington, Pa., has enlarged its plant until now it has a capacity of 50,000,000 carbons per year. The company announces that it proposes to continue in the front rank and has arranged for a supply of raw material for the next two years. It will guarantee its carbons to be as good as any made. The company also announces that it is not in the carbon trust and does not propose to enter it.

Merit Wins.—The New York Central and Harlem railroads have been experimenting for some time as to the best wires and cables for equipping their telegraph, telephone and signals from Forty-second street through the tunnel to Mott Haven. They have now decided to use the "Kerite," manufactured by S. A. Day, formerly A. G. Day & Co., and have placed their order with Mr. W. H. Eckert, the New York agent. This installation will require over 1,000,000 feet of wire, including submarine cables across the Harlem River.

Dynamo Oils.—The use of a poor quality of oil in the oil cups or the self-oiling boxes of dynamos and motors, simply because it is cheap, is a penny wise practice. The results obtained, not the first cost, should influence the engineer. Central station men who have used the special dynamo oil manufactured by George P. Jones & Co., of St. Louis, speak in high terms of its efficiency and the economy in consumption. Some of the largest stations in the world have adopted this oil in preference to any other, after a series of tests given to show its value.

The Clark Electric Company, of 192 Broadway, New York, has been awarded a special silver medal by the American Institute, at the close of the sixtieth annual exhibition, for the Clark electric search light. The new features of this light created considerable interest, as the arc lamp was turned in every possible position and burned perfectly at every possible angle. The Clark company is constantly bringing out new improvements in arc lighting, of which it makes a specialty. The company has already established a high reputation for its arc apparatus of various kinds which it manufactures.

The Columbian Movable Sidewalk Company, of Chicago, gave a public exhibition at the World's Fair grounds of its movable sidewalk this week. The two movable sidewalks are about 300 ft. in length and encircle an oval space. One walk moves at the rate of three miles an hour while the speed of the inner walk is about six miles an hour. The company hopes to have its system adopted at the World's Fair and believe that its feature of continuous motion will certainly recommend it. The necessary current for the 15-h. p. street car motors is furnished by a Thomson-Houston generator driven by an Ideal engine.

Electric Railway Supplies.—The "close of the season" does not seem to affect the business of the Electric Merchandise Com-

pany. The winter weather creates a need for a number of its specialties. Particularly large sales of Brand's patent track brooms, Wardwell's track broom holders and the Burton electric heaters are being made. Of the latter, orders to roads in the following places have been filled the past week: Ottumwa, Ia.; Reading, Pa.; McKeesport, Pa.; Cleveland, O.; Lincoln, Neb.; Martinsburg, W. Va.; Salt Lake City, Utah; Sioux City, Ia.; Marquette, Mich.; Wheeling, W. Va.; Quincy, Ill.; Williamsport, Pa.; St. Louis, Mo.; Ottawa, Can.; Wilkesbarre, Pa.; Shamokin, Pa.; Bloomington, Ill.

Recent Sales.—The New York office of Thos. Dallett & Son, of Philadelphia, which is in charge of Mr. Newton L. Schloss, has been open for business but a short time, scarcely four months, but in that time has made a very good showing. A few of the recent sales of motors reported are as follows: Chas. Hurst, electrotyper, 113 Nassau street, 10-h. p.; R. C. Williams & Co., grocers, 15-h. p. motor for elevator work; Montague & Fuller, 28 Read street, 5 h. p.; Smith & Seward, coin makers, 5 h. p.; Chas. Vogt & Co., 132 Church street, 1 h. p.; N. Y. Biscuit Company, Tenth avenue and Fifteenth street, 1-90 k. w. generator, 1 100-h. p. motor, 1 125-h. p. Triumph valveless compound engine, direct connection on one base, wiring for 1,200 incandescent lamps, etc.; 2 Hunter clutches, etc.

The Weston Standard Voltmeter in Germany.—W. Le Conte Stevens, writing to Mr. Edward Weston, vice-president of the Weston Electrical Instrument Company, Newark, N. J., says that the Weston standard voltmeter is held in very high esteem in Germany. At a lecture recently attended by him at the Polytechnic School in Zurich, the lecturer, who was a member of the Testing Commission at the recent Frankfort Electrical Exhibition, said he had subjected the Weston voltmeter to various tests and found it in the highest degree satisfactory—the best thing from America that was exhibited at Frankfort. As an illustration of the excellence of the magnet employed, he stated that an instrument having fallen accidentally upon the floor, its subsequent indications were not affected more than one-half of one per cent. by the mishap.

Business Notices.

Watch Page V Next Week.—The Washington Carbon Company will have some more facts to relate.

Battery Cut-Out, Cheap.—Sensitive, reliable, never requires attention. Gas lighting much improved by its use. Electric Supply Company, of 105 South Warren street, Syracuse N. Y

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

U. S. PATENTS ISSUED DEC. 1, 1891.

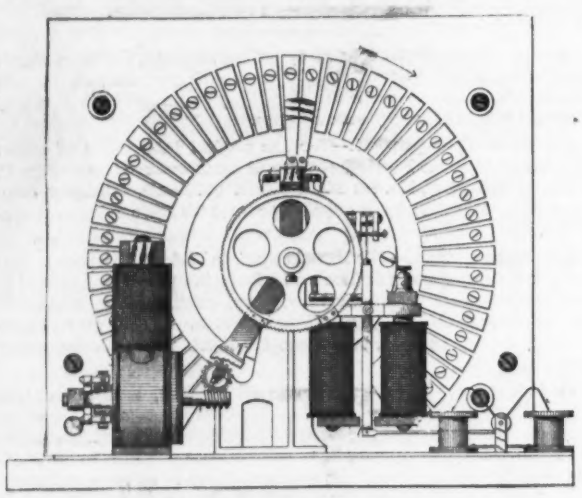
11,207. Open Circuit Battery; John F. Wollensak and William E. Gill, of Chicago, Ill. Application filed Sept. 16, 1890. In open circuit batteries, the combination of a cup having holes through its sides, a carbon stick having a hole in a position and direction to be brought into a line with the holes in the cup, and a pin passing through the holes in the cup and stick. (Re-issue.)

464,001. Telegraph Repeater; Richard L. Atkinson, of Delaware Township, N. J., Assignor to John D. Tustin, of same place. Application filed Mar. 27, 1891. In a telegraph repeater, a local circuit and a cut-off or derived circuit in combination with a main relay and a second relay, the main relay controlling the local circuit and the second relay controling the cut-off or derived circuit, and a second local circuit including the instrument which controls the circuit of said second relay.

464,002. Electric Brake; La Motte C. Atwood, of St. Louis, Mo., Assignor to the Atwood Electric Company, of same place. Application filed Feb. 27, 1891. In an electric brake, the combination of the shoes, a rock-shaft to which the shoes are connected, a pivoted lever connected to the rock-shaft, and two independent magnets located at different distances from the pivoted lever and operating successively for moving the lever at different stages.

464,005. Treating Filaments for Incandescent Electric Lamps; James Bradley, of Massillon, O. Application filed June 6, 1891. In an apparatus for treating carbonized filament, a tube having two vertical portions, one provided with a hydrocarbon chamber and an overflow cup, a cap adapted to hold the ends of conductors, and the filament, and to seal the upper end of the chamber, the other portion having an enlarged portion adapted to hold a quantity of fluid mercury, a pipe to connect said portion with a blower or compressed air chamber, and a fluid mercury piston interjacent the hydrocarbon and the compressed air, whereby the hydrocarbon may be raised to cover the filament and be drawn therefrom.

464,022. Splice for Electric Conductors; Willard J. Hield, of Minneapolis, Minn. Application filed May 15, 1891. The combination of conductor wires, with a bar, having taper ends provided with longitudinal openings and transverse flaring holes



No. 464,136.—ELECTRIC REGULATOR.

provided therein, said wires being bent and passed through said openings and riveted therein.

464,025. Potential Indicator; Carl E. Kammeyer, of Eau Claire, Wis. Application filed May 7, 1891. The combination of a generator, with translating devices in series with each other, a circuit closer adapted to short circuit either of them, said translating devices in multiple arc with the generator, and an electromagnetic device responsive to changes in the potential between the mains and adapted to control such circuit closer. (See illustration.)

464,026. Transformer and Armature Core; Carl E. Kammeyer, of Eau Claire, Wis. Application filed May 7, 1891. An armature core consisting of a series of plates, said plates provided with permanently flexible insulating coats of varnish or the like applied permanently to the plates, which are then built together to form such core.

464,027. Field Magnet for Dynamos or Motors; Carl E. Kammeyer, of Eau Claire, Wis. Application filed May 9, 1891. The combination of a field magnet mass with a series of cores projecting therefrom, each of said cores provided with a groove, a series of spools, a coil on each spool and a spool on each core, and a series of washers adapted to engage said grooves and thus to secure the spools in position.

464,055. Electric Heater; Parvin Wright, of Denver, Colo. Application filed March 21, 1890. The combination, in an electrical heater, of a base and cap constructed of conducting material, an intervening inclosure constructed of non-conducting material, and an inclosed medium of high electrical resistance.

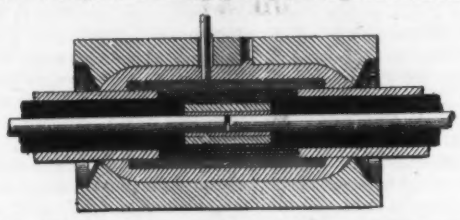
464,063. Electric Motor; Martin H. Collom, of Denver, Colo. An electric motor comprising a solenoid, the latter composed of a series of sections or separate solenoids in juxtaposition, and an endless core composed of a series of magnetic and non-magnetic sections, said endless core being an electrical conductor and adapted to convey the current and complete the circuit through the said sections or series of solenoids.

464,090. Electric Apparatus for use on Railway Trains; Rufus A. Wilder, of Cressona, Pa. Application filed Jan. 9, 1891. In a railway train the combination, with the main traction wheels and their motor or motors of supplemental traction wheels on one or more axles, and apparatus for converting the surplus energy of the locomotive and train into electricity, storing the same and applying it at will through the medium of such supplementary traction wheels to assist the locomotive.

464,125. Method of Testing Insulated Wires; Richard Varley, Jr., of Englewood, N. J. Application filed Feb. 10, 1891. The method of testing an insulated wire, which consists in connecting the wire to one terminal of an electric circuit, bringing the other terminal into close relation to the insulating covering throughout its length, so as to be equidistant from all parts thereof, and charging the circuit with a current of high potential, whereby a flash will be caused where the insulation is below a definite standard.

464,129. Crossing for Trolley Wires; Robert M. Jones, of Salt Lake City, Utah Territory. Application filed April 16, 1891. In a crossing for electric railway trolley lines, the combination of a frame, composed of two similar metal plates separated and distanced by interposed pieces, the line wire sections attached to studs in the plates of the frame and arranged between said plates at the attaching points, the studs and the plates pivoted to the frame between the plates thereof and adapted to fold up between the said plates in line with the wires, the insulating plate attached to the frame between the branches thereof, and the crossing line wire attached to said insulating plate.

464,132. Electric Arc Lamp; William A. Nicholson, of New York. Application filed June 12, 1891. In an electric arc lamp, the combination, with the upper disc carbon provided with means for rotating it as it is fed, of a carrier for said disc carbon provided with guide rods engaged by bearings thereon for steady-



No. 464,475.—JOINT FOR ELECTRIC CONDUCTORS.

ing the feeding movements of the carbon, feeding mechanism and a flexible connection intermediate the same and the carbon carrier.

464,133. Relay; Richard Varley, Jr., of Englewood, N. J. Application filed Feb. 10, 1891. A relay provided with an armature carrying a rearwardly yielding contact mounted to lag under the influence of inertia when the armature is attracted, whereby the circuit controlled by the relay is affected only when currents of definite duration flow through the relay coils.

464,134. Electric Circuit Closer; Richard Varley, Jr., of Englewood, N. J. Application filed Feb 10, 1891. A circuit closer comprising a power driven arm, circuit terminals connected by the arm on reaching a definite point in its path of travel, detents for arresting the arm during or after connection of the terminals, and a controlling device for bringing either detent into action at will.

464,136. Electric Regulator; Chas. W. Holtzer and Geo. E. Cabot, of Brookline, Assignors to the Holtzer-Cabot Electric Company, of Boston, Mass. Application filed April 3, 1891. The combination, with a dynamo or electric motor, of a rheostat in circuit with more or less of the terminals of said rheostat, an armature controlling the movement of said brushes, magnets for said armature included in independent electric circuits normally open, a solenoid in circuit with said dynamo or motor, a pivoted core in said solenoid and carrying a circuit closer for said magnets, and a vertical rotary base plate carrying said solenoid and adjustable at different angles in the plane of said plate. (See illustration.)

464,152. Electric Transmitting Telephone; Rudolph Eickemeyer, of Yonkers, N. Y. Application filed May 23, 1883. The invention consists of a diaphragm and a clamp for confining said diaphragm at its periphery, and electric contacts or electrodes located remotely from the centre of the diaphragm upon the face thereof and substantially in line with the inner edge of the clamp.

464,156. Electrical Generator; Victor Hirbec, of Paris, France. Application filed Nov. 6, 1890. An electrical generator comprising a pair of cylinders, a paper belt thereon, a heating device to heat said belt, a rubbing-roll arranged above the rear end of the heating device to revolve in contact with the belt, conductors each having a set of conducting points arranged one to receive electricity from the rubber and the other from the belt, and means for rotating the cylinders and rubber.

464,198. Electromagnet; Olof Emil Lundstedt, of Brooklyn, N. Y., Assignor to John M. Glover, of St. Louis, Mo. Application filed Feb. 2, 1891. The combination, with an electromagnet, of an encircling frame of soft iron centrally pivoted to allow the end plates of the frame to swing in unison from opposite directions over the poles of the magnet.

464,216. Armature for Dynamos and Electric Motors; St. John V. Day, of St. Louis, Mo. Application filed May 1, 1890. The combination, with a shaft, of an armature mounted thereon, and means for securing one end of the said armature to the shaft,

No. 464,025.—POTENTIAL INDICATOR.

the opposite end thereof being free to expand and contract longitudinally.

464,231. Electric Motor; John R. Robinson, of Salem, Assignor of one-half to Theodore F. Lawrence, of Peabody, Mass. Application filed Feb. 3, 1891. A stand or support having a swinging electric motor suspended by a gimbal joint from said stand.

464,244. Electric Fire Engine; Mark W. Dewey, of Syracuse, N. Y., Assignor to the Dewey Corporation, of same place. Application filed Feb. 9, 1891. In a fire engine, the combination of a wheeled vehicle, having two axles and a frame, a pump fixed to the front part of the frame, a driving shaft for said pump, extending lengthwise of the vehicle, an electric motor supported upon the vehicle, having its armature-shaft lower than the driving shaft of the pump, and gearing between the shafts.

464,245. Electric Hose Carriage; Mark W. Dewey, of Syracuse, N. Y., Assignor to the Dewey Corporation, of same place. Application filed Feb. 24, 1891. The combination, in an electrically propelled vehicle, of an electric motor mounted thereon and connected with the axle or wheels to propel the same, a secondary battery carried by the vehicle below the horizontal plane of the axis of the driving wheels, and electric connections between the battery and the motor. (See illustration.)

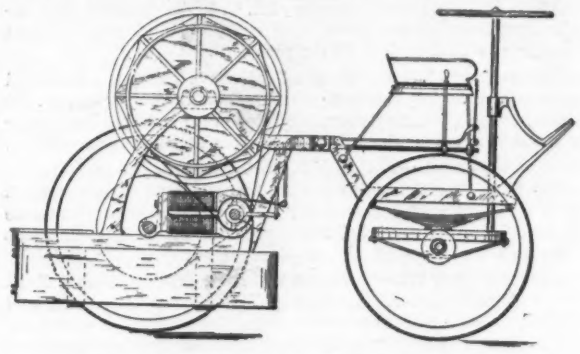
464,246. Electrically Propelled Vehicle; Mark W. Dewey, of Syracuse, N. Y., Assignor to the Dewey Corporation, of same place. Application filed March 2, 1891. The combination, with a wheeled vehicle having two axles, and one of said axles adapted to turn on a vertical axis to steer or guide the vehicle, of a circular rack connected to the axle, an electric motor mounted upon the vehicle, two loose pinions on a shaft geared to said rack and driven in opposite directions by the motor, a clutch between the pinions to clutch either pinion and to turn the shaft, and means to operate the clutch.

464,248. Electrically Propelled Vehicle; Mark W. Dewey, of Syracuse, N. Y., Assignor to the Dewey Corporation, of same place. Application filed March 23, 1891. In an electrically propelled vehicle, the combination, with wheels on opposite sides of the vehicle adapted to turn relatively to each other, of an electric motor having its armature and field-magnet adapted to rotate in opposite directions, the said field-magnet being geared to and arranged to communicate rotation to one wheel, and the said armature being geared to and adapted to communicate rotation to the other wheel.

464,267. Electric Heating Apparatus; Mark W. Dewey, of Syracuse, N. Y., Assignor to the Dewey Corporation, of same place. Application filed March 9, 1891. In an electric heating apparatus, plurality of independently movable cases, an electric heat-developing conductor within each of said cases and covered with a powdered or fibrous refractory material, and a frame to hold or support said case.

464,299. Electric Motor; Herman A. Florian, of Detroit, Mich., Assignor to Edward A. Florian, of Fostoria, O. Application filed Jan. 6, 1891. The combination with a revolving armature, of a field-of-force magnet composed of four electro-magnets arranged in pairs on opposite sides of said armature and having their inner ends united by pole pieces extending above and below the top and bottom of said armature, respectively, and having their outer ends united by cross bars to form a rectangular frame at right angles to the axis of the armature, a base secured in the recess formed in the under side of the lower pole-pieces and provided with insulated bearings for the armature shaft.

464,342. Method of and Apparatus for the Propulsion of Trains; John B. Mahana, of Freewater, Ore. Application filed



No. 464,245.—ELECTRIC HOSE CARRIAGE.

Jan. 24, 1891. The method of creating and storing an auxiliary propulsive power for use in an emergency without impeding the forward movement of the train, which consists in generating electricity by the rotation of the car-wheels on a down grade, storing such electricity and overcoming the resistance to the forward movement of the train caused by such generation by using the power of the prime motor in addition to the force of momentum of the train on the down grade.

464,368. Insulating Support for Electrical Apparatus; Smith W. Kimble, of Denver, Colo., Assignor to the Mica Asbestite Insulation Company, of same place. Application filed Feb. 25, 1891. The combination, with a non-conducting block, of terminal connectors, each having projecting teeth or lugs imbedded in the material of the block, which is molded and compressed around the same, and having on its upper surface projections for the attachment of electrical conductors, said projections serving also to keep the fitting in place while the insulating compound is molded around it.

464,370. Trolley Wheel for Electric Railways; Smith W. Kimble, of Denver, Colo., Assignor to the Mica Asbestite Insulating Company, of same place. Application filed May 29, 1891. A trolley wheel comprising in combination two side pieces, each constituting a hub and flange in one piece, said pieces being screwed together, and a contact ring let into a groove formed in and between the two side pieces.

464,371. Trolley Wire Hanger; Smith W. Kimble, of Denver, Colo., Assignor to the Mica Asbestite Insulating Company, of same place. Application filed May 29, 1891. The combination of a continuous metallic bulb or shell tapering in form and flanged or turned under at its large end, so as to leave a small central opening therein, a mass of molded insulating material filling the bulb and held in place by the underturned edge thereof, and a metallic fastening attachment having its head imbedded in said mass, the bulb being hermetically sealed at the mouth by waterproof material.

464,411. Hanger for Trolley Wires; Thomas E. Adams, of Cleveland, O., Assignor to the Brush Electric Company. Application filed July 17, 1890. In an insulator, the combination, with a shell constructed in such manner as to be closed by a plate having depending flanges and insulating material in said shell, of a stem imbedded at one end in the insulating material in the shell and projecting at its other end beyond the flanged plate.

464,470. Electric Elevator; William Baxter, Jr., of Baltimore, Md. Application filed Dec. 8, 1890. The combination in an electric hoisting machine, of an electric motor having magnet cores inclined upward and inward from their bridge, a hoisting drum and intermediate gearing, and a magnetic frame or bed provided with a transverse bar having upturned lugs at its opposite ends to receive the magnet cores and provided with a lateral extension to support the drum and intermediate gearing.

464,475. Joint for Electric Conductors; Henry W. Fisher, of Pittsburgh, Pa., Assignor to the Standard Underground Cable Company, of same place. Application filed March 7, 1891. An electric cable consisting of two or more portions of armored conductors having their ends united by a hollow cast metal joint forming an integral part with the adjacent sections of the armor. (See illustration.)

Copies of the specifications and drawings complete of any patent mentioned in this record—or of any other patent issued since 1886—can be had for 25 cents. Give date and number of patent desired and address The W. J. Johnston Co., Ltd., Times Building, N. Y.